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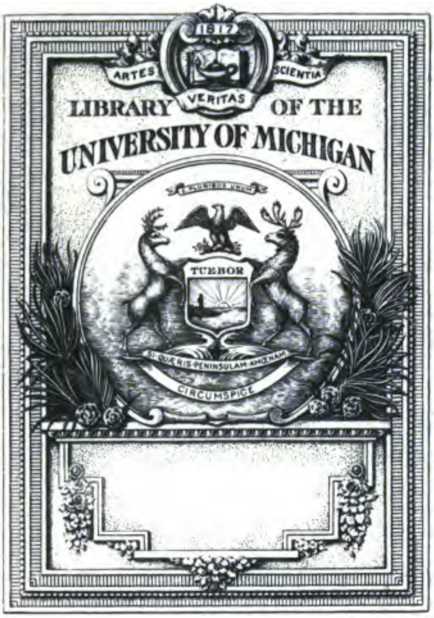

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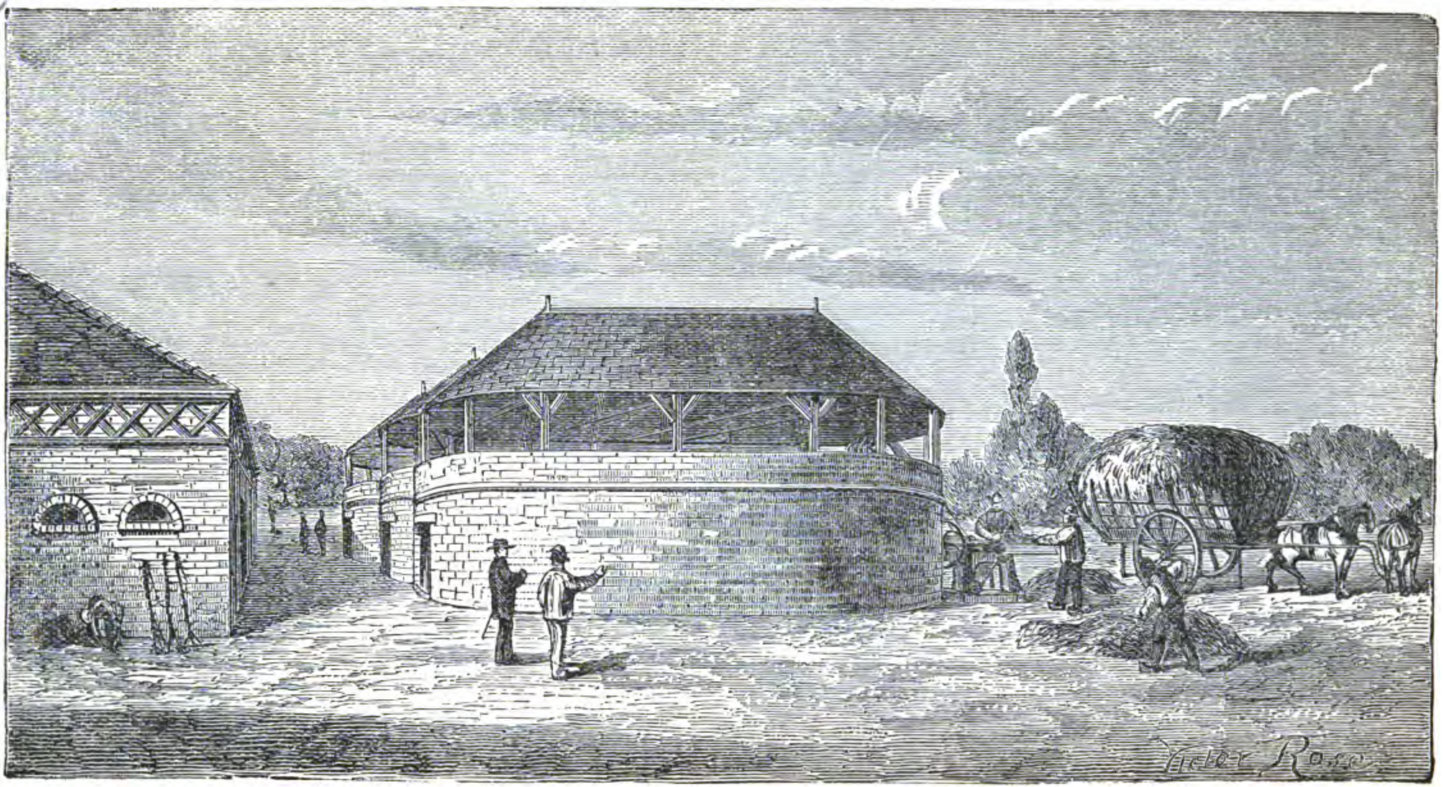

THE SILOS OF MONS. GOFFART AT BURTIN.

ENSILAGE.

A SYSTEM FOR THE PRESERVATION IN PITS OF FORAGE PLANTS AND GRASSES, INDEPENDENT OF WEATHER.

BY

*T.*homas *CHRISTY, F.L.S.*

A COLLECTION OF FACTS AND STATISTICS
ON THE CHEAPEST MODE OF PROVIDING WINTER FOOD
FOR DAIRY CATTLE, SHEEP, HORSES, &c.

LONDON:
CHRISTY & CO., 155, FENCHURCH STREET, E.C.

1883.

Price One Shilling.]

[*Ent. at Stationers' Hall.*

LONDON:
A. SOUTHEY, PRINTER, 146, FENCHURCH STREET, E.C.

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195
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Gift
Parke Davis & Co.
8-8-1934

PREFACE.

The establishment of a yearly Congress in the United States to represent Farmers who have adopted the principle of feeding their stock with fodder preserved in the green state by the process of Ensilage, warrants me in believing that the time has arrived when a book describing the system, and giving drawings of the silos, will be appreciated.

The Analytical Chemists in the United States who took part in the 1883 Congress, joined in a resolution passed, urging the universal adoption of the system of Ensilage by the farmers of the United States, and stamped the system with their approval.

The facts I have collected show that if cows are fed on ensilaged fodder in winter, they will give such a rich quality of milk that the butter made from it is as firm and yellow as in summer. A Farmer or a Chemist may dry the green stem, and the sap in hay, but they are unable to reproduce the forage with the sap in it in a succulent and green state. To show how the conservation of this sap or juice in the forage can be effected by easy and economical methods, is the object and aim of this compilation.

I am indebted to the following Gentlemen for their assistance:—

C. J. Taylor, Green Hill Farm, near Burlington, N.J.
Dr. L. W. Weeks, Oconomowor, Wisconsin.
Hy. Lapham. Minnewor Farm, Oconomowor, Wisconsin.
F. Morris, Oakland Manor, Howard Co., Mass.
O. B. Potter, 26, Lafayette Place, New York.
Chas. S. Wheelwright, Providence, R.I.
E. Wright, Atlantic City, N.J.
W. B. Eager, Middletown, Orange County, New York.
Dr. Ormiston, 17, West 32nd Street, New York.
H. R. Barker, Lowell, Mass.
Geo. Morton, Essex, Vermont, U.S.A.
C. W. Wolcott, Reedsville, Mass.
W. R. Strong, Goldin's Bridge, Michigan.

Also to the Writers of the Books, &c., consulted:—

Silos and Ensilage, by Dr. Geo. Thurber, of the *American Agriculturist.*
The Book of Ensilage, by John M. Bailey, New York.
Experiments with Ensilage at the Agricultural College, Lansing, Mich., 1881 & 1882.
Agricultural Review and Journal (of New York and Chicago), Nov., 1882.
Department of Agriculture Special Report, No. 48, *Silos and Ensilage.*
On Ensilage of Green Forage Crops in Silos, by H. R. Stevens.
Report of Proceedings of the Ensilage Congress, New York, Jan. 25 & 26, 1882.

The Weekly Sun, U.S., Feb. 1st, 1882.
The Times; The Field; and *Live Stock Journal.*

THOS. CHRISTY, F.L.S.

Malvern House, Sydenham, S.E.,
February, 1883.

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ENSILAGE.

The principle of Ensilage has been known from the earliest times, when grain and fodder used to be preserved by burying it; but Ensilage itself has not received the attention of scientific men until the present century.

Griewold describes the system in 1842, when referring to the pitting of fine grass in East Prussia. Mr. Goffart says, in his work on Ensilage, that he commenced to study the question of the preservation of green crops or forage in 1852. He had for a guide, his countryman the Duke of Liancourt, who no doubt had seen this system in practice during his travels in Hungary or in Italy—perhaps he may have been struck by seeing the Swiss peasant collecting the leaves and tufts of scanty herbage, and treading them into a pit for a store of food to be used when the ground should be covered with snow. For my present purpose, it is not worth while referring to those who have known and practised the system of Ensilage in the past, except to show how backward farmers have been in adopting a safe plan for storing fodder.

Thanks to the rapid dissemination of information through the Press, such useful results have been chronicled that the process of Ensilaging fodder cannot be overlooked. To Mons. Barral, Perpetual Secretary of the French Chamber of Agriculture, is due the honour of at once examining into the experiments of Mons. Goffart, and publishing them in his *Journal de l'Agriculture*, and it was his opinion, so strongly expressed, that caused me to look into the subject and adopt his views.

The publication of a few of the facts, with drawings, in my first edition of *Forage Plants* in 1877, brought the Ensilage system before the farmers in the United States, and many of them then wrote to me for further details. From that time I have gone on collecting information and proofs of its value. With silos in full operation in this country, no one need now say, "Where can we see a silo?"

My last work, No. VI. *New Commercial Plants,* led me into the study of fibres, and I was kindly assisted by Mons. Vétillart, of Paris, who is the greatest authority on the subject, having written, and illustrated with the aid of his microscope, a standard work on fibres. While working at this subject I became convinced that although farmers had proved by experiments that ensilaged fodder was a great gain over dry hay and roots, there was an immense field opened out for the chemist in investigating the changes which take place in the sap in plants in their different stages of growth and development of flower and fruit. Mons. Vétillart admitted that if flax and hemp were allowed to remain in a growing state on the land until the ripe seed could be collected, then the stems would not rett, and the fibre would be useless for purposes of weaving. This is the reason why the flax and hemp is pulled before it ripens, and is placed, before it dries, in ditches and ponds, so that the filaments may be separated from the cellular matter. Mr. C. D. Ekman, F.L.S., finds that it is best to treat these fibre-yielding plants when ripe, and after the farmer has secured his crop of seed. On the other hand, Mons. Vétillart says the present machinery for spinning cannot treat the fibre if taken from the ripe plant. The paper makers can get 40 per cent. of very good fibre from hemp, and 25 per cent. from flax. These few facts show how little is known about the treatment of such important staples, yet no one in England has turned his attention to finding out when grasses ought to be cut. Mr. Geo. Fry, F.L.S., has worked chemically as an amateur for seventeen years at the question of the formation of the sap and gummy matters that hold the fibres together, and his research leads him to affirm that there is a splendid field open to the chemist in this direction. He thoroughly believes in the advantages of Ensilage, and has constructed and partly filled a silo on his farm at Chobham, Surrey, with maize, which when opened on the 6th of January, 1883, was found in splendid order, the cattle eating it greedily. Although this silo was only a trench in porous soil, it had withstood the downpour of rain, and no water had entered the silo.

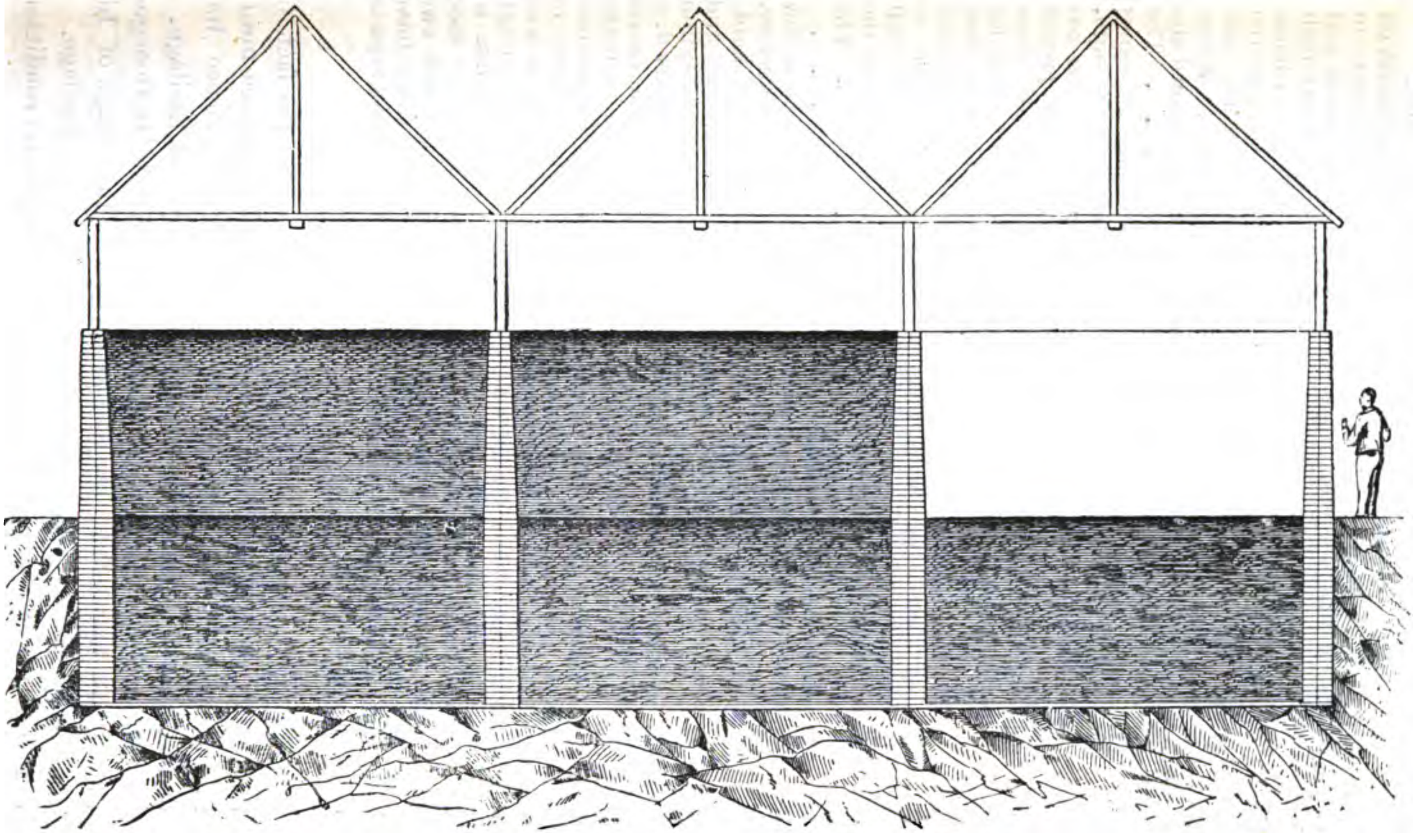
Mr. C. D. Ekman, F.L.S., discovered the valuable solvent action of Bi-Sulphite of Magnesia on the substance that agglutinates together the fibres or cellulose of the pine tree and other woods or fibrous plants. This invention he patented, and by his discovery the chemist has under his control the examination of all plants and fibres, and also the sap or fluid that passes up the stems. Subsequently, Messrs. Cross and Bevan (who were until lately working in the Joddrell Laboratory, Kew, and who are now united with Mr. Fry), as late as Nov., 1882, read their papers before the Chemical Society, and also the Society of Arts, on the chemistry of cellulose and other compounds found in plants, and their mutual relationship.

The system of Ensilage consists in preserving green forage plants in a pit for winter use, or during a dry season, without their turning mouldy or rotten, and the word is derived from the Spanish language—*En* in, *Silo* a pit. The green crop is cut in the field and carted to the silo, where it is cut up into lengths of ½-inch to 1-inch by a chaff-cutter, and placed in the silo and well trodden down. The whole secret of success is the exclusion of air from the FODDER; this is explained fully in another part of the book, and will be understood from the letters on each page, which I have selected with care from the United States Government reports, from correspondence in the *Times* and *Field*, and from private letters sent me as furnishing the latest information. The plants and grass should be in FLOWER when cut, for then they are in their most favourable condition—the sap and saccharine matter being in the stem. The latest information on the subject of Ensilage (see letters from *Field*) shows that young grass can safely be ensilaged, and this is a most important point to prove, for if succulent matter like the aftermath, green clover, comfrey, vetches, &c., can be ensilaged, the dairy farmer's provision of winter food, hitherto such a source of anxiety, is easily provided by the surplus green food he can grow during spring and summer.

In the construction of the silos, very little has been changed since the time of Mons. Lecouffe, who in 1876 constructed the silo for economy on the side of a hill. Mons. Goffart built his silos close to his feeding sheds, and adopted the rounded corners and open roofs as shown in the frontispiece kindly lent me by Mons. Masson of Paris.

The *Times* (Oct. 20th, 1882) has rendered a great service to agriculture by publishing a letter from its own correspondent, giving details of what was witnessed this autumn on the estate of the Vicomte de Chezelles :—

"The proprietor of the château where I am staying, M. Arthur Vicomte de Chezelles, is not unknown in England. . . . To-day was opened for my inspection probably the largest silo, filled with Ensilage, in Europe. In Holland during the month of May, I had the pleasure of joining the party of Norfolk farmers and landowners, to see the various aspects of 'Dutch farming.' Lord Reay and others accompanied us, and a visit of a week enabled the party to learn much of the methods and condition of agriculture in Holland. I wish to refer here to an Ensilage pit seen on one of the best working farms in the whole country, which attracted more interest among the score of Norfolk farmers who saw it than anything else seen on their travels. The cows on a large and well-appointed dairy farm were eating, liking, and thriving on Ensilage as a part of their principal winter and spring food. More milk was given by the cows that ate Ensilage than those which did not. At the end of the visit, the most satisfactory and practical comment made was, 'Some of us will try that plan in Norfolk.' As a matter of fact, I believe such an experiment on a small scale is now being tried, and in Suffolk, Colonel Tomline has also put up a silo. . . . The report from the United States is that 'the conditions of stock fed on Ensilage, both as to health and gain in 'weight, has been uniformly favourable,' and 'as to the profitableness of 'Ensilage, there is hardly a doubt expressed on this point, certainly not a 'dissenting opinion.' As they have arrived at these conclusions in America, it is time that Europe, and especially England, with its uncertain climate, should adopt a system pronounced to be both healthy and economical. 'I know that as soon as the fodder is in the silo it is 'safe ; I have no fear of storms or rotting in the field,' is the phrase of an American farmer, writing on the subject. In suitable climates and soils, simple earthpits are recommended as efficient and the least costly, but generally English and French agriculturists may reckon that a built silo is preferable, and the one I am inspecting is so contrived 'a double debt to pay.' It is at the same time an excellent barn and perfect silo, and may be described as an oblong open shed, roofed with tiles, 72 yards in length, 6½ yards wide, 4½ yards high, to all appearance a building under which the cereal crops should be stored ; it is, in fact, a Dutch barn. But the floor, instead of being level, is sunk some 12 feet, the walls are lined with rough stones and cement, and the floor is paved, while the bottom level is drained. In this pit, which may be compared to the hold of a ship, there is at this date stored the produce of 170 acres of trefoil, lucerne, tares and grass. This produce nearly fills the whole pit, a space being reserved at one end for the remnant of last year's Ensilage. As the forage was cut by mowers, five men followed and loaded the carts, and the green-stuff was delivered at the side of the silo into the carriers of a powerful chaff-cutting machine, three men feeding it as two men on the loads pitched the forage off the carts. Thus ten men were occupied and were paid by piece-work, 8s. to 16s. per 2½ acres, according as the crops were light or heavy. The chaff-cutter, driven by steam, goes on incessantly, and the cut green-chaff is stowed and levelled by a couple of workmen, and, moreover, twice a day two bullocks or two horses are walked over the mass and give it compactness. A sprinkle of salt is added occasionally, and gives an appetising flavour which animals like. As soon as filled, and without boards, straw, or other covering, about 1 ft. to 18 in. of earth is laid over the surface of



SECTIONAL VIEW OF MONS. GOFFART'S SILOS.

forage, and the store is made complete, and forms in three or four months the Ensilage which will be mainly the winter food of the farm stock.

"All this I had known before arriving at Liancourt, St. Pierre, on Wednesday, to see with my own eyes the outcome of the experiment—to see if, instead of the muck that many would expect, a nutritious and wholesome food could really be obtained . . . and have fed with both the new and old Ensilage the bullocks, seeing them take it as a horse takes a mouthful of hay, eating with a relish. The appearance of the building was that of a great barn, and as a matter of fact the roof sheltered much of the cereal produce of a farm of over 500 acres. Wheat and oats in the straw from the floor to the angles of the roof formed the upper storey of the mass of Ensilage that was below. . . . The smell was rather agreeable than otherwise—much the same as comes from breweries. The temperature of the mass was decidedly high, almost more than the hand could bear; but this circumstance was not considered any objection, and the previous year's experiment had proved that such temperature was unattended by any danger. I took three samples, packed them in tin cases, and sent them off to England for analysis. I also took a fourth sample of the old (1881) stock, that portion which had been thrown in uncut at the end of the silo then unroofed, and upon which much rain had fallen. This section is certainly damaged and inferior, but it is not so bad but that it is still eatable, after having been uncovered and exposed to the air during the past summer. Certainly the opening of the silo was a success. The food stored there was good provender for the coming winter. . . . The Ensilage is simply cut away as wanted, just as would be a few trusses of hay from an ordinary stack. This fact promises, therefore, that cubes of Ensilage, instead of being regarded as so much perishable green food, may be eventually made into marketable blocks for dairy and other cattle, thus extending its use, which is now limited to consumption on the farms where it is produced. Should this expectation be realised, a great proportion of English forage, grass, &c., is likely in the future to be made into Ensilage without farmers waiting for sunshine to make their hay. Certainly the results of chemical analysis may be awaited with interest, even although practice has already proved the value of Ensilage. At the Château Boulleaume farm, horses and sheep, as well as bullocks and milch cows, are fed and kept in good condition through the winter on Ensilage. The quantity given daily is about 20 lbs. to horses, 50 lbs. to 70 lbs. to cows; but, of course, some nitrogenous food may also be profitably mixed with it. On this food for the past two years 20 horses, 36 bullocks, 120 milch cows, and over 1,000 sheep have been successfully fed, and the different animals have been always kept in excellent condition."

In prefacing his information, the writer chronicles the fact of the visit of some English farmers to Holland. The reference made to the sprinkling of salt must be explained. Experience has decided that salt should only be put on the top layer of Ensilage.

The novelty to be observed in this report is that Mr. Georges, the steward, had utilised the roof of his silo for the storage of his grain crops, which served to weight the mass of Ensilage. I examined the clover from this pit, and it was in splendid condition.

The *Field* of 4th November, 1882, contains the following valuable analysis:—

This tabular statement represents the percentage composition of the samples of fodder, consisting of trefoil, lucerne, tares, and grass, cured on the Ensilage system by the Vicomte de Chezelles in 1882.

ANALYSIS OF ENSILAGE.

Volatile Matter :			
Water		50·30	per cent.
Free acetic acid		1·20	,,
Alcohol		1·80	,,
Solid Matter :			
Albumenoids*		9·12	,,
Ammonia		0.06	,,
Fatty matter		2·07	,,
Soluble carbo-hydrates :			
Sugar (maltose)	2·94		
Starch and digestible cellulose	2·23		
Pectous substances (gum, mucilage), &c.	10·32	15·49	,,
Insoluble carbo-hydrates (fibre)		14·35	,,
Mineral matter (ash)		5·61	,,

* Containing nitrogen, 1·44 per cent.

The following represents the composition of the substance (when dry) contrasted with two samples of dry lucerne analysed by Dr. Von Wolff, of the Hohenheim Imperial Experimental Station, Germany. The first sample was dried with care on a barn floor; the other (a portion from the same crop) was dried in the field in the ordinary way. During the first two of the four days to which the latter sample was exposed to the atmosphere, it became subjected to the action of a slight shower of rain and to a thunderstorm:

	Ensilage.	Carefully-dried Lucerne.	Field-dried Lucerne.
Albumenoids	18·35	17·00	14·94
Fibre	28·87	31·81	33·90
Fat, Soluble Carbo-hydrates and Alcohol (if any)	38·95	43·80	44·22
Ash	11·29	7·39	6·94

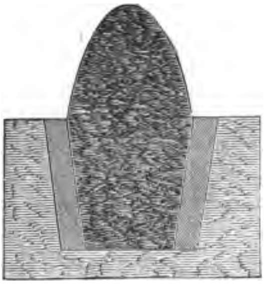
The above figures so clearly show the high feeding value of this sample of Ensilage, that they may be allowed to speak for themselves. I wish only to point out that, contrary to generally accepted opinion, my experiments lead me to believe that the sugar formed by the fermentation of Ensilage is not "grape sugar" or "glucose," but "sugar of malt," or "maltose." The acetic acid, although of course indicative of the loss of nutritious feeding material, is probably not without value as a condiment. Its amount in the above sample is much less than in the specimen of highly fermented hay, the analysis of which was given in my "Chemical Investigation of Hays" (the *Field*, Oct. 14).

I am now engaged on the analysis of a sample of English Ensilage, which will, I hope, help to determine whether English fodder plants are really so unsuitable for this process as some suppose. I am also examining a sample of M. de Chezelles' Ensilage of 1881, and am trying at the same time the effect of exposure on the above samples.

F. WOODLAND TOMS, F.C.S.

7, Busby Place, Camden Road, London, Nov. 2.

The drawings below show the sections of a silo. No. 1 is as it appears just after the cut-up fodder has been put in, and before being covered. No. 2 shows how the fodder appears in course of shrinking or sinking, and the earth is trodden down to prevent any openings for the escape of the gas. No. 3 is the appearance of a pit six months after filling. The dimensions of these pits may be made according to desire and the space at disposal; but American ingenuity has turned space to the best account. As I shall draw largely on the information furnished by my American friends, I must at once note some of the differences that exist in the United States. They have, as a rule, a long and cold winter, which necessitates all cattle and stock being kept under cover day and night. Again, it is alleged that root crops are not grown in the United States like those produced in Great Britain, and Sir J. B. Lawes, in the letter quoted below, states that mangel and turnips do not appear to occupy any important position in the United States for winter food for cattle, so he argues that Ensilage is of little importance to this country. A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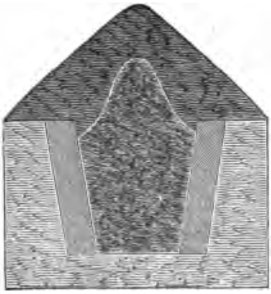
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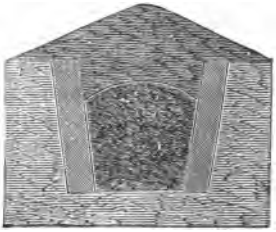
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A There can be no reasonable doubt that profitable agriculture in the future will depend more than it has ever done before upon the successful management of stock. The relation between corn and the various products of the animal is no longer what it was; while the price of the former has a continuous declining tendency, that of the latter continues to advance. . . . Any process, therefore, which would enable the British farmer to obtain a larger supply of food at a less cost would doubtless be a great boon.

Granting all that has been said in favour of Ensilage to be true, its importance is not quite the same to the British farmer as it is to those who farm in France or on the other side of the Atlantic. The main object of Ensilage is to secure a succulent food for consumption during the winter months. In the agriculture of the States and of France, such roots as mangels and turnips do not appear to occupy any important position as regards winter food for cattle. We have a succulent food of

It must not be forgotten that dairy farms are always short of green food during the winter, and that when cattle are fed on roots the flavour of the milk is at once deteriorated, whereas with the Ensilage, it is improved, and equal to summer milk. The more uncertain the climate, the more valuable is any system that enables a farmer to secure his crops irrespective of weather.

Again, it is stated that it is necessary to add dry food to the roots, hence in this country advanced farmers chaff their hay, worth £4 to £5. 10s. per load, and also straw, and mix meal of some sort with it; some go so far as to steam the chaff to try and soften it, and awake the flavour the fodder once possessed. The reply to Sir J. B. Lawes and Prof. Voelcker comes to me from Mr. G. Morton, of Essex, U.S.A., as follows:—

> If the English farmers will try for themselves the new system, I am sure they will be benefitted more than we are in this drier climate of America. Some of your writers think roots can be raised as cheap in England as corn can be ensilaged. Let any farmer try it one year, and he will convince himself that nothing can be raised and preserved as cheaply as corn can in silos. Of course, all the grasses can be preserved as well. I shall be most happy to answer any further questions, and serve you in any way I can.

---

the best possible description already, and, if anything, we rather require a dry substance to mix with it, than a still larger amount of succulent matter. The question, therefore, as far as we are concerned, is considerably narrowed. It does not affect those who make hay for sale, nor those who feed their grass, clover, or tares in the summer; it merely affects those who convert a portion of their clover or meadows into hay for their own consumption; and it is a question for them to consider whether, on the whole, Ensilage can supersede haymaking with advantage. No information on this point is given in the article on Ensilage published in the *Times*. We are told, indeed, that the stock ate the food and throve upon it, but we are not told what was the amount of loss attending the process itself, or, in other words, for each 100 lbs. of sugar, starch, and other digestible product put into the silo, how much came out. . . . The heat generated, and the smell of alcohol and acetic acid, to which the author also alludes, can have had no other source than the sugar which is found so abundantly in Indian corn at the time of blooming. Last year I wrote some articles on the subject of Ensilage, which were published in the United States, and I then pointed out how serious was the loss of the nutritious portion of the plant which appeared to take place in the silo. I concluded by remarking that, although under the conditions of agriculture that prevailed in the States, Ensilage might be profitably used, still I hardly thought that the British farmers, who had to produce the food for their stock at a great cost, could afford to adopt a system which apparently destroyed so large a proportion of the nutritious matter.

On this same subject of roots, in reference to Ensilage, Professor Voelcker writes to the *Times*[B] endorsing the remark of Sir J. B. Lawes, and wishing it to be understood that succulent crops, such as clover and grass, cannot be preserved without the admixture of considerable proportions of chopped straw. Now this is a question which is open to discussion. There is no doubt but that anyone having a large surplus stock of straw not easily to be disposed of, may utilise it with more advantage if it is cut up short and put it into pits with very succulent crops, rather than give it to the animals as is at present done in this country in the form of hard dry food, as chaff. It only softens and becomes permeated with the spare sap given off by the clover or grass, &c. It has lost its fattening and sustaining properties when the sap has passed into the flower and seed.

It is also a very open question whether for good Ensilage it is necessary to add any chopped straw to grass cut when young, or to other succulent crops.

[B] Sir John B. Lawes, in his letter published in the *Times* of to-day, has brought the discussion on Ensilage, as regards its applicability to this country, to a very narrow point. He has clearly shown that it only "affects those who convert a portion of their clover or meadows into hay for their consumption, and it is a question for them to consider whether, on the whole, Ensilage can supersede haymaking with advantage." . . . It must also be borne in mind that Ensilage is not practised even on the Continent or in America for the conservation of grass or other equally succulent foods without the admixture of a considerable proportion of chopped straw. Grass of fair average quality by itself is not put into silos in these countries. According to the more or less succulent constitution of the green food, such as maize or sorghum, from 10 to 30 per cent. of chopped straw has to be mixed with the succulent food before it is pressed down in properly-constructed, walled, covered, and perfectly water-tight pits. Without the admixture of chopped straw or similar dry materials, grass placed in silos, according to my experience, derived from the examination of specimens which have been sent to me by experimental agriculturists during the last few years, turns into a sodden mass of repulsive smell and taste, resembling more rotten farmyard manure than feeding material. . . . Sir John B. Lawes has directed attention to the great loss in sugar, starch, and other nutritive substances under favourable circumstances. I fully endorse his views, but would add that under adverse conditions the loss in the elements of nutrition will be still greater, and Ensilage under such conditions may prove a complete waste of food. . . . While, then, we can in England grow large crops of succulent food, such as turnips, swedes, cabbages, tares, rye, clovers, and other green crops, and consume them on the land or in the cattle stalls without any expensive or troublesome process of preservation, English farmers ought not to attempt to grow maize and other crops which are suitable for Ensilage, but unsuitable for our English climate.

Mr. Thorold Rogers, M.P., recently took up this Ensilage question, and briefly described what he saw when in the United States, and I am much indebted to his assistance in keeping this question before the public. [C]

The Right Hon. W. E. Gladstone was appealed to in the House of Commons in November, and at once replied to Mr. Thorold Rogers that he was alive to the importance of the subject, and on the 29th November, 1882, I received a letter from the Board of Trade, asking me to furnish the Commercial Department with Ensilage samples from different silos, and any information in my possession, and I caused specimens of both rye and trifolium ensilaged in England to be sent there. Ensilage is so much a matter for private enterprise, that I do not see how the Government can render much assistance. When the Press is convinced of the merits of the system, the information will be circulated. Next year we shall probably find notices that some of the exhibits at the Dairy and Cattle Shows from the Royal farms have been fed on Ensilage food.

Dr. Lyon Playfair, M.P., records what he has seen in the United States, as his experience is opposed to the views expressed by Sir J. B. Lawes and Prof. Voelcker in the *Times*. [D]

[C] I should not presume to argue on practical agriculture with so eminent an authority as Sir J. B. Lawes, but I am at a loss to understand how he has concluded that so much loss on the given article could be resultant from storage in a well-constructed, properly-covered, and adequately-weighted silo. The object of silo storage is the preservation of the article in a state as nearly like green forage as possible. Some slight fermentation there is, but there is little or no heat, and, as I was told, little or no evolution of carbonic acid.

As to the greatly increased yield of produce from the food given, they who give testimony are unanimous. I saw the cattle, inspected the dairy produce, and learned what was the monthly yield of milk by cows fed on the system. My friend's name is Havemeyer.

[D] For the last three years I have taken much interest in the progress of Ensilage in the United States. This system of preserving food for cattle progresses with great rapidity, and this fact alone, in a country of such practical aptitudes, shows that it deserves careful attention. No doubt exaggerated estimates of its value prevail; but, with due allowance for these, the results are remarkable. My friend, Col. Cannon, a well-known breeder of shorthorns in Vermont, has taken up the system with much caution in comparative trials of the new and old system of feeding, careful records of weights being preserved. So far as these have gone, he obtained an advantage of about 8 to 10 per cent. in the feeding power of the silo food. But it has various incidental advantages which induce him to give a large extension this year to his experiments. In fattening cattle, or in feeding them for dairy produce, The concurrent opinion is that a farmer, if he has meadows that yield generally a good crop of hay, should do his best to secure it in good order in large stacks. From his arable land he can get sufficient clover, trifolium, tares and rye, or other succulent crops for his silos. The volume of food he can save for the winter is so great, that he can largely increase the number of his cattle, and consequently he will have more than his ordinary quantity of manure. He will be able to put half as much again on his land, and have cash for the purchase of his cattle by the sale of his meadow hay.

The question of first cost of silo is boldly faced by Mr. G. Morton, of Essex, U.S., who has abandoned an expensively built silo for a wooden construction close to his feeding sheds. [E]

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it is of importance to induce the cattle to eat as much as they can properly assimilate. Now, if silo food and the ordinary food be put into the same trough, the cattle, in all cases in which I have seen the experiment tried, take the former instead of the latter.

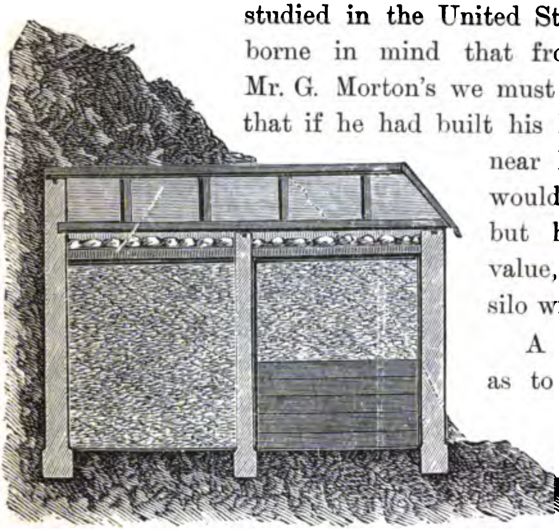
To preserve food in silos many precautions are necessary, and I should be sorry to see our farmers rushing into the system with their limited experience. When carefully conducted, I have never seen a failure ; though, on the other hand, I have seen putrid instead of preserved food turned out of imperfect silos.

The greatest success has been with Indian corn, which is put into the silo just as the ears are being formed. My only knowledge of agriculture is scientific and not practical, and it will be for practical farmers to tell us whether, even with the vicissitudes of our climate, there are not certain parts of England which could grow this profitable crop up to this stage of its maturity.

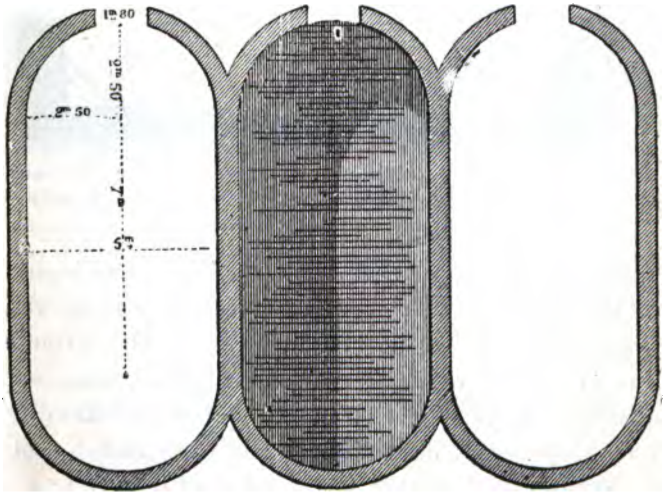
[E] Dear Mr. Christy,—I have no plans at hand that I would recommend for your farmers. The cheapest wooden silos are answering every purpose here. I have a large stone silo that I do not use this year, being so far away from my stock. The silos coming into general use are small ones, built entirely above ground by simply boarding up inside a barn or shed, and filling a foot space with sawdust, or double boarding with heavy paper between the boards. Put the fodder in as fast as can be without extra help, for if Ensilage is ever to come into general use, it must be cheaply raised and cheaply handled. I am now feeding out of a wooden silo that cost only 30 dollars ; have about 90 tons in it, that I put in with the help of a small boy, one horse, and one hired man, all at the extra expense of only 7 dollars. I was 21 days in filling it. Keep the fodder well trodden down about the corners and sides—the centre will not need so much treading—and cover the top with old pieces of boards with two feet of earth or stone for weighting. Herein lies the whole secret, plenty of weight—the more the better—and there is no danger of any green crop spoiling. Of course the scientists will oppose the introduction of Ensilage, as they did here, but any boy can see the influence Ensilage has on the milk, both in quantity and quality. A chemist may be very wise, but will hardly be able to prove that dry fodder is better than green, preserved in silos. Wherever in this country cheap silos have been built, others also have been started, and farmers (I mean those who are poor) have been benefitted.

The drawing shows what is meant by the boards and packing of sawdust or earth between them. Labour is a question closely studied in the United States, and it must be borne in mind that from such remarks as Mr. G. Morton's we must draw the conclusion that if he had built his large and costly silo near his feeding sheds he would continue to use it, but his statement is of value, showing that a simple silo will answer.

A discussion has arisen as to the cost of a silo. This depends on the materials at hand—on the soil—on the water in the soil—suffice it to say, a lined hole into which the chopped-up fodder can be tightly trodden and the air and moisture excluded, answers well. Naturally the larger and deeper the silo the better it is, and consequently if a superior class of lining is adopted the larger it is in size the cheaper it is in proportion per ton of contents.



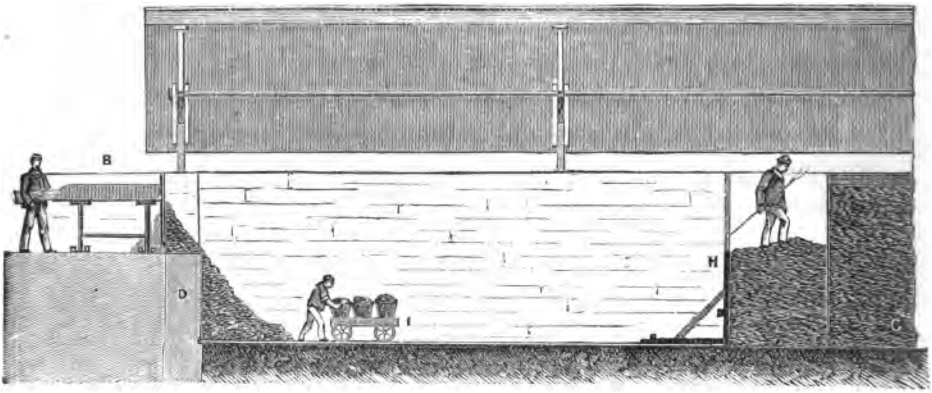
Plan of a cheap form of Silo that could be placed at the side of a hill.



Ground Plan of a Silo at Mons. Goffart's.

The crop should be watched and when it shows for flower, the whole of the sap is then in the stem, and in full operation. This is the time to secure it for the silo, and it should be cut and kept as free from grit and dirt as possible, and carted to the silo. With the chaff-cutting machines an endless web is of importance, as it keeps the green fodder in position as it passes to the rollers, and prevents it from slipping; this refers especially to short grass.

The length found best for hard fodder, such as maize, is ½ to ¾-inch, but for clover or trifolium, 1 inch or more; for rye, if mixed with tares or some succulent crop, the length should not be over an inch; where meadow grass or rye grass is used, owing to its not being of a quality good enough for best hay, or owing to contrary weather, then it is not necessary to cut it short with the chaff-cutter. The greatest secret of all with large silos when short-handed, and when a horse cannot be employed to tread, is to fill in the silo by sections, using a moveable partition made to slide along, and held in position by a prop (as shown in the drawing), and to see the fodder trodden down so hard that all air is excluded. As the contents of the silo sinks, one crop after another can be added.



A, the roof; B, chaff-cutting machine; C, trolly on rails; D, the outside walls; E, centre wall; F, filled silo; G, first section filled; H, moveable partition.

(See also page 31.)

Mr. Charles W. Walcott, of Readville, Mass., has been to some pains to show how well the system of securing crops rapidly by heavily manuring the ground has answered. His letter is dated as late as 17th Nov., 1882. This is after three seasons' experience with Ensilage. I was so anxious to get information from the United States on crops other than Indian Corn, and considered his letter to me so important, that I have inserted it in full:—

"My dear Sir,—My father is a theoretical farmer, engaged in other business, while the practical portion of our operations is in my hands, and together we hope to get at the bottom facts respecting this new branch in agriculture.

"Prior to 1880, we followed the "soiling system," keeping some 50 milch cows and 40 young heifers without a foot of pasture land, and considered that system far superior to pasturing.

"In 1880 we built, after long thought and with many misgivings, a silo of cement concrete (5 parts gravel to 1 of cement), in two rooms, *i.e.*, divided longitudinally by a cement wall, each part being 50 ft. long, 15 ft. wide, and 15 ft. 6 in. deep, with a wooden curbing to the plate of the roof 5 ft. above the sill embedded in the top of the wall, making the total depth 20 ft. 6 in.

"In August and September we harvested our crop, which, by the way, had not been planted for Ensilage, with a result of an average of 12 tons corn fodder, 5 tons golden millet, and 6 tons clover per acre.*

"Our results in 1881 are fully stated in the accompanying report.

"Our results in 1882 I will give as succinctly as possible.

"Having sown winter rye on land planted in corn in 1881, we cut and ensilaged from June 3rd to 8th as follows:—$16\frac{33}{100}$ acres, 99 tons, averaging $6\frac{8}{100}$ tons. May 31st to June 22nd we planted our fodder corn; we harvested from September 4th to 22nd as follows, viz.:—28 acres, $462\frac{1}{80}$ tons, averaging 18 tons.

"You will take notice that by our system of double-cropping our Ensilage lands, we have been enabled to raise an average of $24\frac{62}{100}$ tons per acre. This quantity of forage is sufficient to feed one cow 801 days, allowing 60 lbs. per daily feed. In addition to this, however, some grain must be fed, our experience teaching us that 2 quarts of corn meal and 1½ quarts of cotton seed meal is the best ration.

"Our Ensilage lands have now been planted with corn, summer and winter rye, winters three consecutive years, and the product has steadily increased. We manure for each crop separately, and find our reward therein. Now to your queries:—

"*First.*—We have ensilaged winter rye, sorghum, golden millet, clover, rowen (or second growth) of Timothy, clover, red-top and orchard grass, sweet corn, and the Southern white corn, termed "fodder corn," it being of portly growth and admirably adapted to cutting during the summer to eke out the scanty pastures. This latter is without doubt the best of all, the only objection to clover being that it becomes a pasty, salvy mass, and not retaining its shape. The cattle, however, eat both with avidity, and show better results at the pail or shambles.

"*Second.*—Our judgment is strongly in favour of concrete or brick buildings for silo purposes. Wooden silos have been built, but owing to the great lateral pressure when filled, a heavy structure is required, and, moreover, the escaping gases cause the wood to lose its life, and become brittle and worthless. Pits may be of use, but I have never seen one.

"*Third.*—In October and November, 1880, we were feeding 60 head of milch cows on 20 lbs. best hay, ½-bushel of pulped sugar beets, and 6 quarts of corn meal daily. December 6th, 1880, we opened the silo and fed to same cows 50 lbs. ensilaged corn and frost-bitten millet, ½-bushel pulped beets as before, and 1 quart of cotton-seed meal. The immediate gain of 10 per cent. in milk, and 5 per cent. in butter over October and November production was surprising and well maintained. Finding that the cattle were not so fat as on the dry ration, we added 1 quart corn meal, and almost immediately the cattle responded, and in a month were as fat as before. As soon as dry, they were sent at once to market and sold for beef, the regular market price being easily obtained.

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* See page 52.

"In October, 1881, we turned out on the mowing lands all our cows, to eat down the too luxuriant rowen. The first three days the quantity of milk increased, but afterwards steadily decreased, owing possibly to the fact that the cattle, not having been to grass for some years, spent most of the time racing about.

"As to our present mode of feeding:—July 1st to Sept. 10th—Rye Ensilage about 60 lbs., cotton seed 2 quarts, corn meal 2½ quarts. Sept. 11th to Oct. 1st—Meadow hay about 20 lbs,, cotton seed 2 quarts, and corn meal 2¾ quarts. Oct. 2nd to date—Rowen, not weighed, but cut and fed green, all they would eat, brewers' grains ½-bushel, rice meal 2 quarts. Nov. 26th, shall open silo and feed 50 lbs. corn Ensilage, 2 quarts rice or cotton seed meal, 2 quarts malt sprouts, 2 quarts corn meal.

"The health of our herd has been perfect, not a case of "milk fever," though every cow is fit to kill, and but one case of "abortion" among over 180 cows in the last two years. Young stock flourish finely, indeed our calves are said to be the finest in Norfolk County.

"I have troubled you with a long and perhaps tedious letter, but your *interest*, particularly as a foreigner, demands careful attention."

Mr. Thos. Easdale writes to the *Field*, 6th Jan., 1883:—

Analysis.—Mr. F. Woodland Toms sends me the following analysis and notes:—

Volatile Matters:—		
Water	70·37	per cent.
Acetic acid (free)	0·20	,,
Alcohol	0·08	,,
Solid Matters:—		
Albumenoids*	4·14	,,
Fatty matter	0·80	,,
Soluble carbo-hydrates:—		
Sugars	0·55	,,
Starchy matters	3·58	,,
Pectous compounds (gum, mucilage, &c.)	8·56	,,
Insoluble carbo-hydrates (fibre) ...	9·49	,,
Ash	2·23	,,
	100·00	,,

* Equal nitrogen (all calculated as albumenoids), ·654 per cent.

He remarks that Romsey Ensilage "is, like the French, a very valuable feeding stuff. In composition, its dry matter closely resembles that of hay of good quality; indeed, the albumenoids, or flesh-formers, are considerably higher than in Dr. Voelcker's average analyses of hays—doubtless owing to the fact that it was cut so young." The analysis of the French sample you have already published (*Field*, Nov. 4 last). It was grown by M. le Vicomte de Chezelles, I believe not far from Paris; and I understand that some from the same silo was exhibited at the Islington Cattle Show.

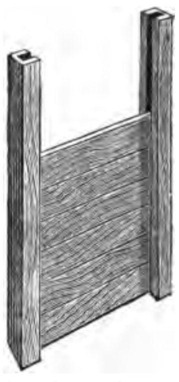
In the following table, furnished by Mr. Woodland Toms, he gives Dr. Voelcker's statement of the average composition of (absolutely dry) hay deduced from twenty-five analyses, and places it in comparison with Ensilage, the three columns showing the composition of the *dry substance* in each. Where no figures are given to sugar, starch, gum, &c., in the hay column, these ingredients were not separately estimated in Dr. Voelcker's analyses, but were grouped together as one item, which is here given as "non-nitrogenous extractive matter;" and, in the analyses of the samples o Ensilage, it will be seen that the separate items are totalised and stated in parentheses, for the sake of comparison.

	Hay, average of twenty-five samples.	Grass Ensilage, grown at Romsey.	French Ensilage (clover and grass).
Albumenoids	9·88	13·97	18·35
Ammonia	—	—	0·12
Non-nitrogenous extractive matter	48·09	(43·77)	(37·22)
viz., Acetic acid	—	0·67	2·41
Alcohol	—	0·27	3·62
Sugars	—	1·86	5·92
Starchy matters	—	12·08	4·49
Gum, mucilage, &c.	—	28·89	20·78
Fibre	31·80	32·03	28·87
Fatty matter	2·99	2·70	4·15
Ash	7·24	7·53	11·29
	100·00	100·00	100·00

In Dr. Voelcker's conversation at the last half-yearly general meeting of the Royal Agricultural Society, he is reported by the *Agricultural Gazette* (Dec. 25th, 1882) to have said, "I do not think ordinary meadow grass at all suited for Ensilage, as it does not contain a sufficient quantity of dry matter. . . . You must have at least 20 per cent. of dry matter. . . . In the case of ordinary grass thus preserved, you must leave them in the land until they become woody, but then you lose the best part of the grass." Without presuming to criticise such an authority as Dr. Voelcker, I would point out that, according to the above analyses, my Ensilage (which was ordinary meadow grass, cut young) and that grown in France (which was chiefly clover, with a little grass), are both said to be superior to the ordinary run of hay; and there is no doubt that it is cheaper to ensilage grass than it is to make hay.

Another correspondent writes me that he has worked Ensilage for three years, and he has applied it to red clover, pearl millet, West Indian millet, green rye, green oats and mixed grasses, in which clover predominated, with entire success in every case. Among all my kind friends in America, I have had to select those who have worked with grasses, clovers, and "English green crops," for I have only the farmers of Great Britain to convince that Ensilage is a commercial success.

The openings shown in the diagram on page 24 are closed by dropping boards into a slot. The depth of pits (referred to in this letter) is remarked by all large feeders. The greater the density of the Ensilage, the more profitable it is. The small


Boards let into a slot in the posts.

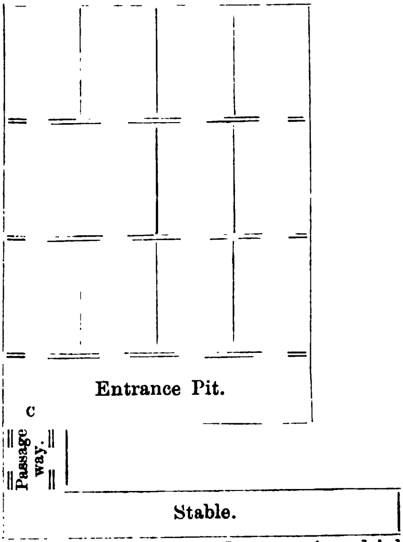
divisions keep up the mass, and prevent undue exposure after the pit is opened and the contents being worked. [F]

[F] “ The last year I preserved about one hundred tons, and during this summer I have put down about two hundred tons, and have added sorghum and sugar-cane to the varieties of fodder I have before preserved. I have *never lost any fodder whatever* thus preserved, but during the whole experiment it has been perfectly preserved and better than when fed fresh and green from the field. As the first fermentation is passed in the process, the food thus preserved has no tendency either to scour or bloat the animals fed. . . . Another important advantage is gained by this process : These fodder crops may be allowed to attain a much larger and more substantial growth before cutting, than is practicable when the same crops are used for feeding fresh from the field.

“ During my absence from home in the summer of 1879, my foreman had inadvertently allowed a field of about four acres of pearl millet to attain so large and hard a growth that my cows wholly rejected the stalks, and would eat only the leaves when the millet was offered them green.

“ By way of experiment, and without much confidence in the result, I cut about one-fourth of this field and filled one of my pits with it.

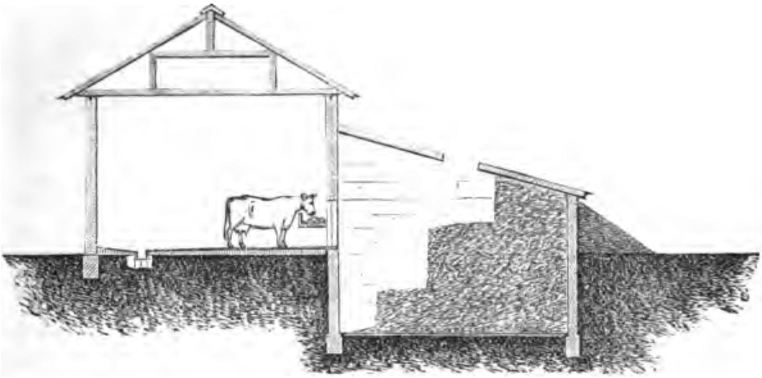
“ The remainder of the field was cured by drying in shocks in the ordinary way. This last was found so nearly worthless for feeding dry, that it was used for litter in the barnyards, and for covering ice. That preserved in the pit was opened and fed in April last. My cows ate it all, leaf and stalk, eagerly, without any loss or waste whatever, and it was fully equal in value to the same quantity of the best corn fodder preserved in the pits. . . . The pits should be of such form and dimensions as will best facilitate the settling and compacting of the food into a solid mass, and when opened for feeding will expose as small a part of the surface to the atmosphere as practicable. . . In all cases where practicable, pits should be made at least 20 feet deep. The walls are made so smooth upon their inner sides as to offer no obstacle to the settling or compacting of the food by friction of the sides. These pits are made either open at the top and covered with a roof, or arched over and covered underground, with two necks to each coming up to within one foot of the surface of the ground, through which they are filled, and the necks are then sealed with earth. This last construction I have found most convenient in connection with basement stables, to which the food is carried or wheeled by a passage from the pits through the foundation walls of the stable. In this construction I make one pit parallel with this foundation wall, and from the side of this pit most distant from the stable, other rows of pits are made at right angles with and connected with this, and with each other by doorways, as will be understood from the annexed diagram, which represents a horizontal section of pits thus constructed taken through the doorways near the bottom of the pits:



Much advantage will be gained by mixing clover and grass, in which

In every report and on all occasions it will be found that the air-tight silo is recommended, and so much was this fact impressed on a friend of mine that I have sketched his silo, admirably situated and built at considerable expense, to show that mistakes may occur even with clever people, if they have not the faults pointed out to them.

This drawing shows a silo at the back of the feeding sheds. I visited it soon after it was opened. It will be noticed that there is a man-hole in the roof through which the Ensilage was passed; but it is evident that, when full, it would not be possible for a man or a beast to work it down solid. The consequence was that the top layer of the Ensilage in this pit, for a foot, was mouldy, and the mass was not pressed down nearly tight, and there were no weights to follow down the shrinkage; so this mistake must not be forgotten. The cover of the silo is being altered, and an open roof substituted to keep off the wet. Fortunately the mistake did not happen to a poor man. Even under these adverse circumstances, the Ensilage, after the top layer was removed, was found to be in good order, and the cattle ate it greedily.



So great is the enthusiasm in the U.S.A., on the subject of Ensilage, that it was made the principal topic by the President of the Agricultural Society, President Hazard giving his own experience. He paid for a careful analysis, as some of his hearers were temperance men, and did not approve of such rich food being

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clover predominates, in the same pit with fodder corn, millet, or sorghum. The clover becomes after the first fermentation a putty-like mass, which fills the interstices in coarser and more fibrous fodder, and thus makes the whole much more compact and weighty than it would otherwise be, while it improves the quality of the food.

given to the cows. Little did President Hazard know that our own Customs Officers declared some ensilaged clover from France to be fine American tobacco, and I put the box containing the French Ensilage of clover, brought over by Mr. Kaines Jackson, before several gentlemen, and they, judging from the smell, also guessed it to be a Tobacco. G

Where you have to make a silo on wet land, and you cannot get below the surface, this drawing is one of the cheapest plans for a wooden silo. The lightest roof that will hold on is sufficient, and no better covering is to be procured than large sheets of thin sheet iron, about 10 ft. by 4 ft. They can be tarred

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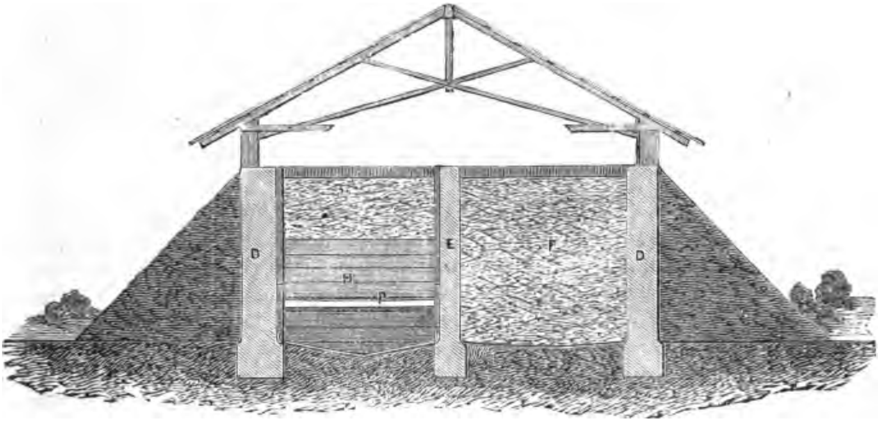
G President Hazard, speaking at the Kingston Fair, Rhode Island, urges the great importance of Ensilage to farmers, and the value of the results obtained this year during the drought which visited the State, and which in many instances destroyed the fruit crops as well as the corn. He states that his own silo is 12 feet wide, 16 feet deep, and 60 feet long. The corners are cut off, or rather filled with masonry, and the walls are laid in cement 2 feet thick, with a cement floor as tight as a cistern; there is a door in the lower end, opening to the level of the ground, through which the contents are taken out; when the silo is filled, planks are fitted across this opening on the inside flush with the wall, and earth tightly packed in behind them. He merely placed boards on the top, and weights above them, and he found no loss from mouldy surface. He calculates that he placed about 300 lbs. weight to the square foot on the boards.

The analysis shews that there is nearly four-tenths of 1 per cent. of alcohol, this gives 6½ ozs., or 13 tablespoonfuls to every hundred pounds weight of Ensilage. Of acetic acid, there is a little over one-tenth of 1 per cent., or 1⅔ ozs., or a little more than 2 tablespoonfuls to the hundred pounds. Some objectors say, as vinegar only contains 5 per cent. of acetic acid, this acetic acid is equal to a quart of strong vinegar, and as rum is nearly half water, this alcohol is equal to three-quarters of a pint of rum, and both are contained in 100 lbs. of Ensilage. Teetotalers say the acid is not food, and the rum must be hurtful. Those who have tried Ensilage, say that if it does contain acetic acid and alcohol, it does not cause any ill effects to the animal. For instance, ¾-pint of rum in 9½ gallons of water would make a very weak solution, but in the case of Ensilage, as it is mixed with about that quantity of water, and 23 lbs. of substances besides, its character is changed; it is also possible that the peculiar condition of the alcohol in its nascent state may alter its physiological effects. No one can assert that both the alcohol and the acid are not digested. We know that in the human system, acids are necessary to health when salted provisions form a staple food, possibly it may be found they have a place in the food of cattle when they are fed with dry fodder.

Whatever acetic acid and alcohol there is in the Ensilage, is due to the decomposition of sugar; it is certainly better to preserve the sugar in its proper form, rather than have it decomposed. The only way to effect this preservation is by preventing fermentation.*

* Doubtless also the small proportion of alcohol tends to preserve the fodder and prevent fermentation, or at all events mouldiness.

and nailed on to the rafters. The edges can be allowed to overhang. The opening, or door, of such a silo should be near the feeding house or cattle shed. The same system of shifting boards before referred to, can be utilised for the opening, but care must be taken to cut the Ensilage down straight from the top. The wall may be made of double wood framing, filled in with concrete or sawdust, according to convenience, the dip in the floor is shown in one shed, but this is quite unnecessary, for there is no drainage if the crop was in flower when cut, and the mass is well pressed and made air-tight by being weighted.



D, concrete or brick walls ; E, centre division, of wood or stone ; F, ensilage ; H, boards (as at page 23) ; P, boards forced up.

Mr. Thorold Rogers, M.P., who has really studied the system, wrote an excellent letter to the *Times*.[H]

[H] "The conditions under which agriculture is practised in the Eastern States of the Union are far more adverse than they are in our country.

A silo can be packed with all kinds of green fodder. Maize, rye, clover, millet, cow peas, grass, all and every kind of green food for cattle except roots, can be used.

Even in the best of circumstances, dry feed in the winter, with sliced roots, may enable the herd to do without water, but dry feed requires water, and cold water in an American winter is not the best thing for horned cattle. Besides, roots spoil milk, or at least, butter. Now, if one could find a food for cattle which is equally good all the year round, which gives as good a yield of milk and butter, and of as good quality or colour, in winter as in summer, the seasons, as far as cattle-feeding is concerned, would be averaged, and nearly all the effects of winter would be obviated.

This is what is asserted to be done by ensilage. It is not all which ensilage is said to do, but part, and a great part of what it does. By adopting it, a stock breeder and dairy farmer supplies himself with a forage which is good all the year round, which the cattle devour greedily, He shows that the Eastern States' farmers are in no better position than the general run of men in this country; and as to root crops not being grown, Messrs. H. A. Bartow and Sons say they like Ensilage better than roots. I

In regard to horses, further experiments will have to be made, for, under certain circumstances, Ensilage does not answer. Mr. Otis Bisbee relates a case of this sort.—(See note K on p. 29). He is not singular in noticing that the milk from cows fed on Ensilage is beneficial for children. This fact may have been admitted by others, but has not been published. K

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leaving not a fragment of it, under the use of which they thrive, so as to be in perfect condition, and from which they make the largest registered yield at the smallest cost. I find, for instance, that several of Mr. Haremeyer's cows yielded more than their weight of milk every month from February to June inclusive. In one of these cows, taken at random, the heaviest yield was in February and March. These cows were imported from Jersey in the autumn of 1880, and the register is of 1881.

Of the residue of Mr. Haremeyer's estate, one-third is kept for hay, one-third for pasture, one-third for silo crops. From the produce of the latter from 150 to 200 cattle, cows, bulls, heifers, and calves are fed all the year through, and, as I have said, give as good and marketable a produce in winter as they do in summer. I was told that the forage of this year was the produce of 97 acres.

None of the parties who met appear to have been dissatisfied with their experience, and I am told that the number of persons who are building silos on farms in the Eastern States is rapidly increasing.

I cannot help thinking that Ensilage, for reasons of climate and soil, would be more fitted for the United Kingdom than it is for the American Union. They who practise it say that it doubles the fertility of the land at a stroke."

I "We have resorted to root crops for the last five years; we liked them very much, but Ensilage is better; it does not cost nearly as much in labor and fertilizers, and gives better results."

K "My cattle and one horse have sleek coats, look healthy about the eyes, and bear the general appearance of thrift; another horse I never succeeded with."

"Must depend on circumstances; where the silo is near the crop, I can't see how it can fail to be profitable. Even with the disadvantage of having the crop raised at a distance, I think I realize returns for all I expend, and more. It seems to me that chemical analysis reaches only a part of the whole question. The vital forces concerned in digestion are more important. A mere boy sees the connection existing between flush, tender pasturage, and full pails of milk. Tell the boy that the tender grass is little else than vapor, that such a large per cent. is water, easily procured at the brook, that such a small per cent. is ash, that the parts that go to make fat and muscle and butter, after the water is removed, are an insignificant amount, and he may stare and wonder at your learning, but you will fail to convince him that the dried grass is better for milk than the fresh grass in the pasture. Let me add that a

It is important to note this experience, for although it is exceptional, it shows caution is necessary.

Mr. D. Bookstaver, of Syracuse, records his experience, viz., that with horses, colts, and sheep, Ensilage is equally good. L If anyone will watch animals eat Ensilage, it will be observed that they try to lick the sugar off the stuff, and that they ultimately lick out the manger.

Colonel Le Grand B. Cannon, after experience with roots, gives his opinion of Ensilage as compared with roots ; so do many others. M

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young child fed on the milk of an Ensilage-fed cow has no irregularity of the bowels, is good-natured, and grows finely.

"Sheep thrive. Have fed horses but once. Last fall we fed a mare and weanling colt from the same Ensilage that we gave to other stock. The colt died after three or four days, and the mare after five or six. Symptoms were inability to swallow, chewing food and dropping it, holding mouth in water without drinking; and in the mare's case, excessive scouring. We attribute it to the Ensilage, as our other horses, hay and grain-fed, were perfectly healthy.

"We estimated that our silos paid their cost the first year, though only half-filled, notwithstanding loss of valuable blooded mare and colt. We have found Ensilage better feed for cows than clover-hay cut before bloom and 'mow browned,' which was the best fodder that we had ever used before."

L "It is equally good for horses, colts, sheep, &c. I prefer to feed dry corn, or barley meal, or linseed meal, with Ensilage ; it does well without this by feeding hay once a day. Perfect health, bright eyes, smooth coats, and soft skins.

"The most profitable food ever used. I made some experiments last winter in feeding a heifer, cow, mare with foal, weanling colt, and an old trotting horse. Cut timothy and clover hay, mixed in a large box with an equal amount of Ensilage, adding a little corn meal, coarse bran, and shorts, and allowing the feed for the morning to remain over night, and again preparing in the morning for night. All were wild for their feed, and never left a spoonful to waste. A colt of the same age of mine, larger, and by many considered the best of the two, was fed from the time of taking up, in the old way, with hay given whole, and oats. This spring my colt looked like a two-year-old compared with the other, and at a less cost. The cow and heifer did equally as well. The old horse came out looking like a colt—his coat was never so fine as now, and the mare with foal never did half so well before."

Mr. JAMES S. CHAFFER says, "That the profitableness of Ensilage lies mainly in the fact that it can be made to double the stock carrying-capacity of farms, and that, too, at a small cost. Its advantages to the dairy farmer are incalculable.

M "I consider Ensilage profitable, and believe it is entirely healthy, taking the place of roots. It is easily digested, as is shown by the uniform temperature of the animals, and the condition of the skin and hair.

"Not more than 15 to 25 tons can be depended upon per acre. It is more certain as a crop than hay. Twice as many animals can be kept

Mr. George A. Pierce, of Stanstead, states that he had followed the ordinary English style of feeding with roots, but having heard of Ensilage, he adopted it, and pitted his clover. N

Letters are continually coming to me, asking if clover and grass can be put in the silo, and for this reason I have given extracts at foot, which, if carefully read, will show conclusively what has been done.

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on the same acreage. It is largely a substitute for roots. The labor of feeding Ensilage is much less than hay. The space required to store Ensilage is not one-quarter that required for hay.

"I fed 90 three-year-old steers, divided in three lots; cattle and feed weighed monthly. *First lot.*—Fed 20 lbs. hay with 3 lbs. grain daily; run in yard with shelter. *Second lot.*—Kept in warm stable and stanchions; fed 17¼ lbs. hay, 1 peck mangolds, and 3 lbs. grain. *Third lot.*—Fed 85 lbs. Ensilage with 3 lbs. grain; this lot gained ¼-lb. a day more than No. 2, and ½-lb. more than lot No. 1. The cost 5 per cent. in favor of Ensilage."

N "They commenced to gain as soon as they were fed with Ensilage; they formerly had hay, roots, and some grain. A great advantage over the system of feeding hay and roots in winter."

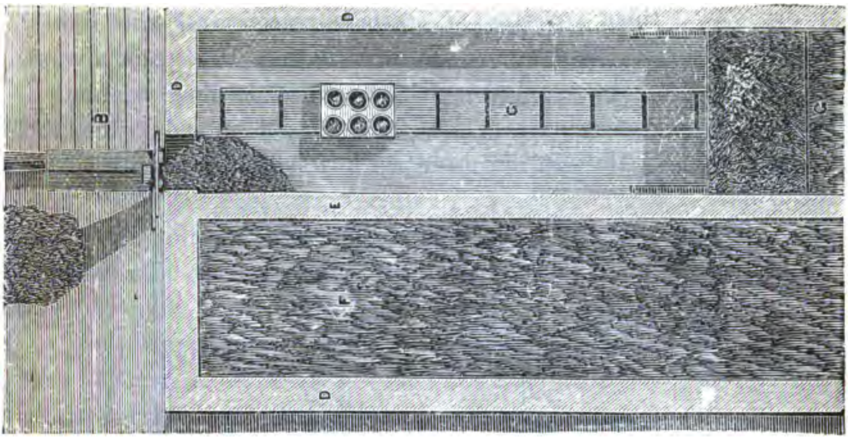
Mr. Geo. T. Powell says that he is keeping four times the quantity of stock with his silos than he could do before. The system is more useful in the preservation of clover, which is so often nearly ruined by wet weather; the same is true with regard to millet.

Mr. Jacob Pugsley says, "I employ grass and Hungarian grass and corn. No harm seems to ensue if the silo is two weeks or more in filling, providing Ensilage is well trodden and packed as put in. Putting in 25 tons per day, there should be three men in silo to spread evenly and pack thoroughly. If I were building again, I should make openings at bottom large enough to admit horses and tread with them, leaving them inside until the silo was filled.

"Ensilage can be put up here quite as profitably at 3 dollars per ton as average hay at 12 dollars per ton; 60 lbs. Ensilage at that price would be 9 cents; 3 lbs. wheat bran, 3 cents—making 12 cents per day. My cows have done fully as well upon this feed as upon 20 lbs. of hay (at 12 dollars per ton), 12 cents, and 6 lbs. corn meal, 6 cents—making 18 cents, 50 per cent. more than Ensilage. Five tons of green grass make a ton of hay; at 3 dollars, this would be 15 dollars. There is not 3 dollars difference between cost of harvesting 5 tons of Ensilage and 1 of hay. In maize the showing is better."

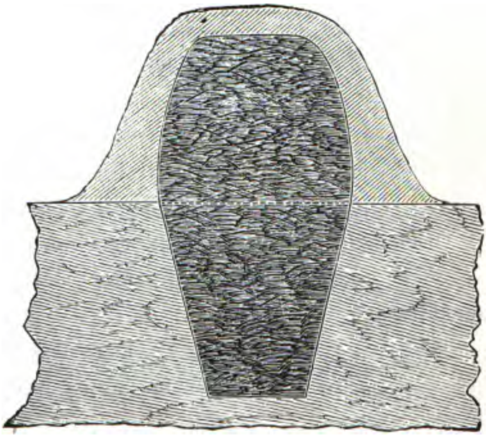
Mr. Alfred A. Reed says, "I employ rye, orchard grass, clover, Hungarian grass, &c. Considering freedom from loss by storms, amount of fodder obtained per acre, cost of silos as compared with barns for storage, and quantity and quality of milk and butter, I consider that Ensilage reduces the cost of feeding about one-half."

Mr. G. H. Ames says, "I consider corn a profitable crop to raise for Ensilage, and the best and cheapest way to cure it for winter use is to Ensilage it. Cattle like it. If good corn meal, or good English hay, or Ensilage, is given them at the same time, they prefer Ensilage, then meal and hay. It takes the place of roots, and is raised much more easily and cheaply. I think all New England farmers should have silos, filled with good Ensilage, for winter use."



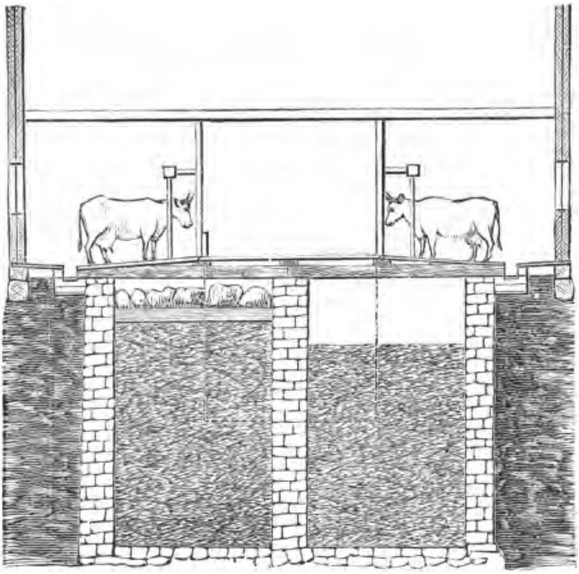
A, the roof; B, chaff-cutting machine; C, trolly on rails; D, the outside walls; E, centre wall; F, filled silo; G, first section filled; H, moveable partition. (See also at page 20.)

This drawing shows one of the silos that exist on large American farms. H is a movable support that enables different crops to be secured, for although the bins get filled, they sink considerably. The chaff-cutter must be fixed to suit the position. The rails are not removed, for they serve to facilitate the emptying of the silo when feeding, as shown at page 20. To ascertain the size of a silo that is required, fix the number of head of cattle you wish to feed, say for 10 cows, and you wish to increase up to 20 cows, multiply together the length, the breadth, and the depth, this gives you the cubical contents of a silo, multiply the product by 40, as there are 40 lbs. Ensilage to cubic foot, and this gives you the number of lbs. in your silo when filled. Divide this product by 21,900 lbs., this being the keep of a cow a year—this will give you the number of cows it will feed.



It is of great importance to press the Ensilage firmly down at the sides of the silo; if the stock of matter is too much for the silo, pack it on and lay planks round the silo, and load the centre with weights.

This drawing shows a section of a Hungarian silo made in a trench dug in dry soil, a thick covering of earth is placed over the fodder to press it down. It answers very well indeed. There is always an objection to the employment of earth and sand without a cloth or paper covering—it is so apt to get mixed with the Ensilage, and cattle get disgusted with food that has grit and dirt in it.



This drawing shows a silo in a cattle shed, and it may suit some people who cannot place a shed at the back of the cattle pen. No dirt or smell can get to the Ensilage, and the cattle stand dry without straw. It may also suit those who live in towns, and cart in the green crops as they ripen.

If it is decided to continue feeding on roots, then one bin could be used with advantage for them. With these sunk silos it is sometimes arranged that the wall is cemented on both sides, and the manure tank is made on the outside of the wall at the back of the cattle. In one letter, a friend writes that he finds the muck twice as valuable when it is taken direct from the cattle shed to the land and not heaped in the field.

In closed silos opened at the base, it is always best to have two men present, for sometimes the carbonic acid gas overcomes them.

Supposing that we take first the dairy farmers, there are a good many now and room for many more, for with Ensilage they will not sell the calves dropped in winter, but will raise them. In the early ages they can be fed from the pail, and as soon as they can eat grass they can be fed with soft succulent Ensilage. My friend, Mr. Chas. J. Taylor, of Burlington, N.J., writes me that one of the largest retail milk-sellers was doubtful, and only accepted milk from one farm that employed Ensilage, until after he had tested the milk with his customers. He became so convinced of the value of the system of pitting fodder, that he begged all his other dairy farmers to adopt it. O

Another authority, Mr. G. L. Clemence, says that he does not chaff rye and clover. I do not agree with this plan for rye, and I fancy that "rye-grass" is intended—for rye, when it shows for flower, is often hard in the straw if the season is dry. P

Mr. Kaines Jackson raised the question if Ensilage could be transported, so I quote a letter from Mr. W. C. Strong, showing how he made a good operation out of it, having commenced by using a water tank for a silo. Q

O "The most convincing incident which has occurred in my experience as to the value of Ensilage for cattle food, has come to me through George Abbott, jun., to whom I sell milk from my farm. (I might say this young man is of good education and respectability, doing a large business in Philadelphia—supplying milk from many dairies to private families, hotels, &c., much of it coming from dairies made up of thoroughbred Jersey cattle.) He has been much interested in the Ensilage question, but has had some fear lest the quality of the milk would suffer from its use. After a thorough trial last winter, he is an enthusiastic advocate of it, on account of the increased colour and improved quality or taste of the milk resulting from its use. He last spring requested a number, if not all, of his dairymen to adopt the system."

P "We use rye and clover, but do not chaff the latter," and he adds, "that we never knew it to fail to increase the flow of milk over dry hay," and "it imparts a taste to the milk and butter analogous to that produced by the green grass of our pastures, but more body. It gives a vigour and healthy appearance not seen in hay-fed cattle. It enables us to make milk and butter in winter as well as in summer, and to keep our stock at one-half the expense of dry fodder. We can keep on the same amount of cultivated land a much larger stock of cattle, thus increasing our supply of manure and the fertility and value of our farms."

Q "As my trial of Ensilage is somewhat exceptional, I will state a few facts which may be of public interest. Having a cemented tank which had been used as a reservoir for water, I tried the experiment of using it as a silo in 1880. Ten acres of Hungarian grass (about 130 tons), very foul with pig and rag-weed, so that it would have been unmerchantable in a dry state, was cut fine and packed in the usual way, and sold during the winter to milkmen at 7 dollars per ton, they doing the carting. They reported that the cows

If the Swiss can ensilage leaves with advantage, Mr. Charles T. Cromwell proves that he can do as well with weeds, and the rushes that spring up in swampy ground cut up well with other fodders.[R]

The opinion of Dr. L. W. Curtis is given below, in which he states what he feeds his stock with.[S]

In regard to mixing straw with succulent crops, there are so many opinions that I give one which coincides with that of Prof. Voelcker. Mr. L. A. Guerber also recommends a trench rather than no silo.[T]

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sought the Ensilage with avidity, ate it clean, and seemed to thrive and give an improved quality of milk over that produced from hay and brewers' grains. Last season the silo was filled with corn of excellent quality, and the bulk of it sold to milkmen at 7 dollars per ton, they coming for it, in loads of 1,500 to 2,000 lbs., about once a week. The reports have been emphatic from purchasers that it was an economical and excellent fodder, the quality of the milk exciting the notice of consumers as more like June milk than they had ever had before. A smaller allowance of hay and brewers' grains was used with the Ensilage. I fed my own cows from a silo at my home farm, and made June butter in January—a new era in my experience. That Ensilage of corn is the cheapest and most wholesome food for milch cows, if supplemented with a small allowance of shorts and hay, I entertain no doubt."

[R] At Rye, New York County, "my experience leads me to believe that everything of vegetable nature that animals will eat, will make useful Ensilage. For example, last year I cut up and packed away in my silo—*1st*, 18 inches of green oats; *2nd*, 6 inches of red clover; *3rd*, 6 inches of Canada peas; *4th*, 2 inches of brewers' grains; *5th*, 2 feet of corn, sown broadcast, more rag-weed than corn in the crop; *6th*, 5 inches of common full-grown grass; *7th*, a foot of sorghum; *8th*, corn planted in drills. I spread over every 6 or 9 inches a light sprinkling of salt, not so much to preserve the Ensilage as to make it more palatable. The cattle and horses ate all, including rag-weeds, greedily. My cows were never so healthy or in so good condition as when fed on Ensilage."

[S] At Southbridge, Mass., "I employ rye, clover, Hungarian oats, rowen, and corn stover. I cut the clover when just coming into blossom; rye just after heading; corn and Hungarian when in blossom; my rowen I put in without cutting; I also pick my corn just as it is glazed, cut the stover and put into silo. It makes good fodder if careful not to let it dry.

"The milk is better while feeding with Ensilage and cotton-seed meal, than with hay and meal. The butter is like June butter.

"All stock like it, and with a little meal, bran, or hay they do better than on the best of hay. They do not have to undergo the change from green to dry feed, and do nearly as well as at pasture."

[T] At Monsey, N.W., "we employ corn mainly. We have found that straw (rye, wheat, or oats) could be advantageously mixed with green corn in the proportion of $\frac{1}{4}$ of straw to $\frac{3}{4}$ of corn. The straw will absorb a part of the juice of the corn, and becomes equally palatable. There is no doubt that clover, rye, and probably bog and salt-meadow grass will

I have received from Mr. Sevin a sample of his Palm Meal, from which most of the oil has been extracted. I think that the tables given below may throw some light on the relative value of other articles employed as food, as compared with it.

In America, cotton-seed cake and other albuminous matter is added to the Ensilage in the silo, and it is found to enrich the food, so it might be worth while to try the Palm Nut Meal by sprinkling the layers as formed in the silo.

Extract from the Journal of the Royal Agricultural Society of England, Vol. XXII., Part II.

Dr. Augustus Voelcker, on the composition and nutritive value of Straw, Clover and Meadow Hay.

Table showing the relative Composition of different Samples of Straw and Hay:—

Details of Composition.	Fairly ripe Barley Straw.	Fairly ripe Wheat Straw.	Fairly ripe Oat Straw.	Best Clover Hay.	Best Meadow Hay.
Moisture	15·20	13·33	13·70	20·50	16·66
Oil	1·36	1·74	1·69	3·59	5·01
Albumen and other soluble and insoluble protein compounds	4·43	2·93	2·75	13·75	8·06
Sugar, mucilage, extractive matters and digestible fibre	8·21	23·66	36·87	29·49	44·86
Indigestible woody fibre...	66·54	54·13	39·57	25·62	17·64
Ash and inorganic matter	4·26	4·21	5·42	7·05	7·77
	100·—	100·—	100·—	100·—	100·—

prove great resources for the farmer if properly ensiloed. We have experimented satisfactorily with clover and rye.

"Cows give as good milk on Ensilage as they do in grass, and the butter has the same colour. A cubic foot is sufficient for one cow. We have never fed it exclusively. Animals require a variety of food to keep in appetite and good health.

"There is great economy in the system; how much, we are not prepared to state. With the primitive arrangements described, our success has been so fair that we cannot hesitate to recommend even the poorest of our farmers to use silos; to build them as best they can. A simple trench in the ground, well covered, will answer. Structures made for the purpose are more durable, more convenient, and may save the fodder better, but all cannot afford the expense, while all can select a dry spot, dig a trench, fill with green fodder, cover with the earth dug out of the trench, and have juicy, palatable food for their stock in winter."

Mr. J. Harrigan says, "the condition of my stock was good. A cow that was old and poor, and gave but one quart of milk per day, was fed 60 lbs. Ensilage, 2 quarts cob meal, and 2 quarts cotton seed. She gained six quarts of milk per day, and was in good condition for the butcher in three months. In all cases I find that the cows prefer Ensilage to hay. I think Ensilage is profitable for any man having six head of cattle, but not for less."

Table showing the relative value and the Composition of Maize, Bran, Oats, and Sevin's Palm Nut Meal:—

(*Analysed by Dr. Aug. Voelcker, Consulting Chemist to the Royal Agricultural Society of England.*)

Details of Composition.	Maize or Indian Corn.	*Extracts from Journals of Highland and Royal Agricultural Society of England.*		Feb. 8, 1876.	Feb. 17, 1876.
		English Bran.	Scotch Oats.	**Sevin's Palm Nut Meal.**	
Moisture	14·00	12·86	11·80	8·90	6·17
Oil	7·70	5·56	6·70	5·52	4·03
Albuminous compounds, flesh-forming matters...	12·00	13·80	13·60	17·63	19·19
Mucilage, sugar, starch, gum, and digestible fibre	60·30	50·17	48·80	54·21	52·25
Woody fibre, cellulose	5·00	11·50	14·80	9·93	14·53
Mineral matter, ash	1·00	6·11	3·30	3·81	3·83
	100·—	100·—	100·—	100·—	100·—

Sevin's Palm Nut Meal is now sold wholesale at £5 . 10s. per ton, delivered free to rail in London.

It must be admitted that the testimony of Messrs. Lincoln Bros. [∪] as to the quality of the butter should be noted, for if in England our farmers cannot get their milk to a station, they surely can make good butter and compete against the Normandy brands. I admit that the railway companies have until recently given no facilities to residents near their lines, but times are changing—although probably one of the last to give facilities will be the Brighton line, one on which no impression can be made, and which imposes rates that entirely preclude business.

I have no direct record from a butcher as to what he thinks of Ensilage-fed beef, so I am bound to accept the evidence second-hand. In W. W. Merriam's letter, who employed clover as well as

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[∪] At Woodstock, "the Ensilage had a light-brown colour when opened, with a slightly acid taste. Our cows did not take to it the first feeding, but it was all eaten up before the next feeding, and after that most of them would eat it in preference to hay, if both were fed at once; two or three would scarcely eat hay if put before them, but would wait for Ensilage. Ours kept about the same until fed out, the 15th of May. If any change, a little more acid smell. For milch cows, we think it ahead of any feed we ever tried.

"The cows gave nearly or quite as much milk as in summer when on grass. The effect on butter was as marked as in the yield of milk, making full as much from the same amount of milk, and being nearly as high-coloured as summer butter. We have regular customers for our butter; all said that it was the best butter we ever made in the winter, and nearly as good as the best of June butter."

corn, he gives the gain in weight to his stock when scaled; so pleased is he that he thinks of adopting it for summer feeding as well as winter. The gain is two-fold—by a careful arrangement, the flies are driven out of the cattle sheds, and muslin curtains put up, and if the sheds are kept dark, the cattle thrive, because they rest and eat, instead of continually fretting and thrashing their tails. V

Capt. Morton began with a trench and then made a silo, and his is one of the first reports to hand in which poultry are stated to have been fed with Ensilage. W

The plan of making a silo 9 feet below the floor of the barn is excellent, if the walls will stand it. Mr. Henry Hoare, of Staplehurst, built the four walls and floor inside the barn, and allowed the walls to rise 5 feet above the floor.

V At New York, "when the silo was opened the odour was much like a whisky still; two months later it was more like a molasses cask.

"When the Ensilage was exhausted, my cows fell off in milk fully one-quarter; even the addition of more grain with hay would not prevent it. The cream did not make so much butter, nor were the colour and flavour equal.

"The past winter I bought some three-year-old Western steers, thin in flesh, but healthy, and fed them for 90 days. The ration per day was 44 lbs. Ensilage, 6 lbs. corn meal, and a bushel of cut corn stalks. They showed marked improvement in 30 days, and continued to thrive beyond the experience of feeders in the old way. At the end of 90 days, my Ensilage being exhausted, I shipped the steers to New York, where they showed a gain of over 1½ lbs. per day, and that after a cold night's ride in open car.

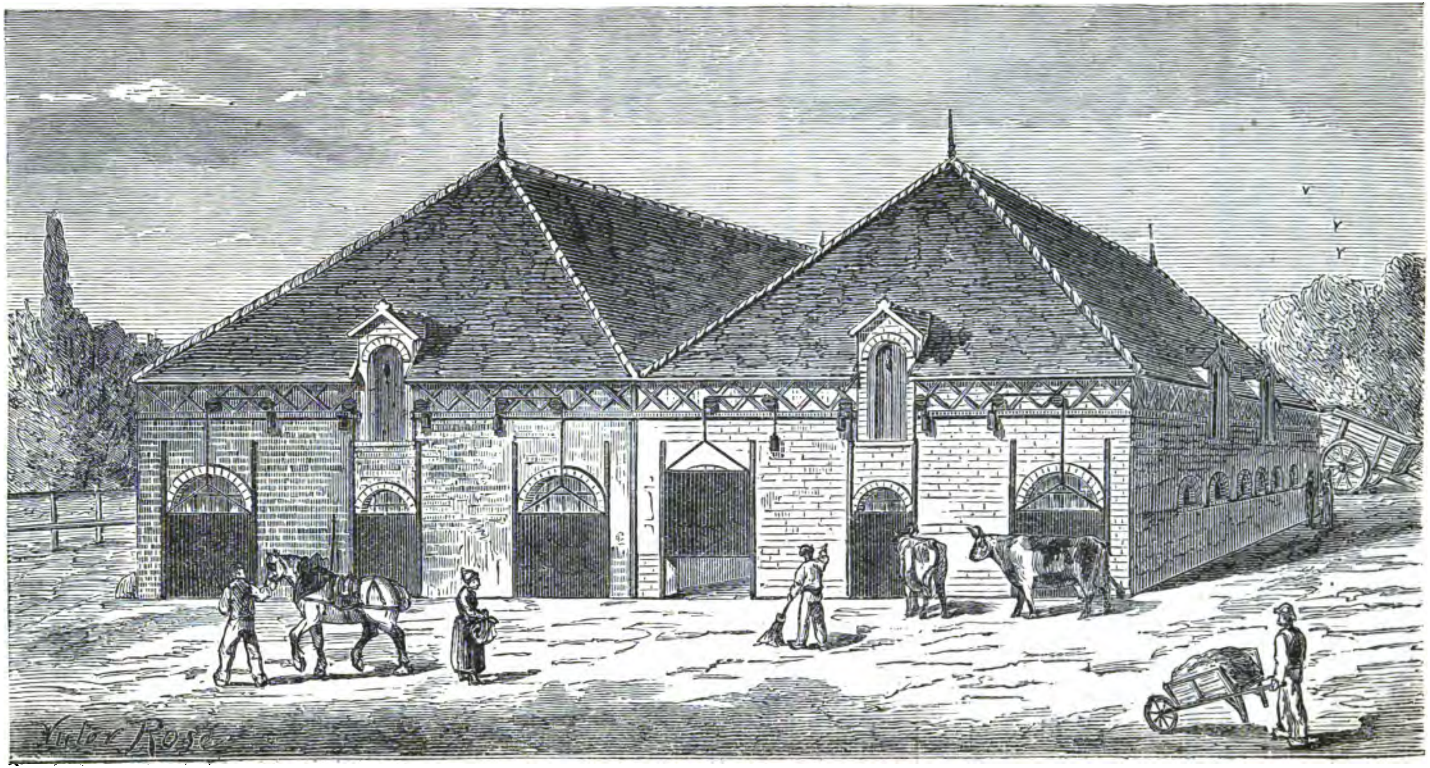
"Every animal I have fed on Ensilage has improved in condition and enjoyed the most perfect health. Jersey calves eat Ensilage with great relish at four weeks of age, and as much improvement is shown in a calf dropped in October as if raised on the best pasture.

"There is no fodder for winter use like Ensilage, and I am thinking of adopting it for summer as well."

W At Essex, U.S., "my first silo was simply a trench in the ground, covered with a few boards and weighted with two feet of earth and stone; fodder put in without being cut came out perfectly preserved. The next year I built a stone silo 60 × 12 × 8½, and last year a wooden silo 15½ × 19 × 20.

"As I used it, I moved the stone until I had 2 feet, or a weight of 300 lbs. per square foot, and the Ensilage improved in quality all the time; better on 1st of May than in October.

"The past winter I gave nothing but Ensilage for four months to all stock; when cows began to come in, 1st of February, I gave 4 quarts of meal and bran, reducing the quantity of Ensilage from 60 lbs. to 40 and 30, until 1st of May, when it was gone. I then increased the grain to 7 quarts, but the cows fell off in milk as soon as I commenced to give hay. I wintered 37 head of horned cattle, a large horse, 6 hogs, and 50 fowls; cows were fat all winter."



MONS. GOFFART'S CATTLE SHEDS ADJOINING HIS SILOS.

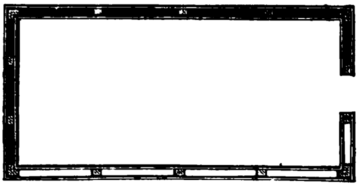
They were composed of rough pieces of stone laid in mortar and faced with cement. This would carry a high bank of fodder.

If gravel is at hand, it answers well if mixed with cement in the following proportions:—

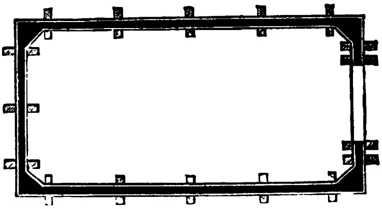
1 barrel Cement,
3 „ Sand,
4 „ clean Gravel or Rubble.

It is best to mix it when dry, then mix it again with water and pour it and shovel it in between the boards, as shown below.

When the boards that held up the cement wall are removed and the wall sufficiently dries, it is as well to fill in all space at the back, to prevent undue settlement, and also because there is considerable pressure on the wall when the Ensilage is tightly packed.



Silo showing the boards nailed on quartering, and sand and cement or sawdust filled in.



This Plate shows how cement walls are constructed by the cement and rubble being run in between, as each course dries the boards are raised.

Mr. E. K. Seabury also records the result of three experiments he made to test the gain in weight of cattle fed with Ensilage. This can be set against English statistics, and my readers can draw their own conclusions. X

Mr. George Thurbie strongly recommends that poultry should be fed on Ensilage. I can understand this if the forage is clover

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X At Walpole, N.H., "I made my silos in my barn 9 feet below the floor. "I regard Ensilage as a success. I can winter more stock at less expense than in any other way I know of, and they come out in the spring heavier and healthier. *Experiment No. 1.*—White cow gained 40 lbs. in 20 days, on 40 lbs. of Ensilage and 4 quarts of meal. *Experiment No. 2.*—Yearling steer just out of pasture (weight 640 lbs.), on 40 lbs. of Ensilage per day, lost 5 lbs. in three weeks; I then added one quart cotton seed meal and a very little hay, and he gained 50 lbs. in two months. *Experiment No. 3.*—A heifer, two years old, on 40 lbs. Ensilage and one quart cotton seed meal and a little hay, made 6¾ lbs. very nice, hard, yellow butter in a week. On 60 lbs. Ensilage alone made 5 lbs., as good colour, but not quite as firm, in the same time, and the cost was less per lb. Various other experiments have brought me to the conclusion as stated."

that has been allowed a few days to dry, after being taken from the silo.[Y]

The cubic foot of well-pressed Ensilage weighs 40 lbs., and 60 lbs. of Ensilage is fed to a cow a day, with 4 lbs. of middlings and ¾-lb. of oil meal or cotton seed cake. The rye crop is cut, and the land richly manured with the cow manure direct from the sunken pits. Prof. Stewart asserts that the manure from one cow carried fresh to the field, the liquid entering the soil, is equal to the manure of three cows carried to the field in the old-fashioned way, after having been piled or clamped.

Linseed meal is much recommended for cows in milk, mixed with the Ensilage. Flax will now pay the farmer to grow, because he can thresh out the grain (linseed), and sell the straw to the paper-maker, if he has not got one of the Ekman cylinders; the paper-maker can get 25 per cent. of pure fibre from the flax straw, and this will be worth to him, for fibre, £18 to £20 per ton. If cattle are allowed to eat the straw, they are apt to have balls form in their stomachs.

In regard to the action of Ensilage on a cow, the following is worthy of note. An accurate account was kept of the weight of milk·

Week prior to opening silo, the cow gave per diem ...	19¾ lbs.
Week after opening the silo	21½ lbs.
Dry food stopped, except meal	24½ lbs.

The cow ate on an average 60 lbs. of Ensilage a day.

One of the first questions to be decided is the precise nature of the substance we will call by the name of "sap" or "juice," as this is the name generally employed to denote the liquid in the grasses, or stems of plants.

In the manufacture of dry food, such as hay, this liquid undergoes a chemical change previous to desiccation.

That such a change has taken place is quite evident from the odour emitted during the transformation of grass into hay, as is also the impossibility of reversing the operation by any chemical process hitherto described, so as to again render hay soft, and as easily assimilated by cattle as the original grass.

[Y] "Calves, turkeys, ducks, and chickens, all but the mules, have eaten Ensilage from the first, and feed with avidity; the turkeys, chicks, and ducks have not had an ounce of grain during the winter, and my turkeys are as fat as under the most skilful feeding. I have been enabled to sell my hay at a good price."

The phenomena attending the transformation of this juice into grain and straw are not less important and inviting to the student.

Although the grain and straw must contain the constituents of the green stem, it will not be contended that an animal fed on the grain and straw will digest so large a proportion of the plant with equal facility as would be the case if it were presented to it in a green state.

It is certainly possible, by artificial methods, again to render the indurated substances less difficult of assimilation by animals. Familiar examples of this are to be found in the conversion of barley into malt; in which case, it will be admitted that the malt contains only the constituents of the original grain, which the malting process has altered and rendered more easy of digestion.

Another example, which will be ready to the mind of every practical farmer, of the chemical changes that take place in the stems of plants turning from the green state into hay, is referred to by several American authors. Mr. J. M. Bailey says, "the modifications are numerous, and rain and dew add immensely to the deterioration of fodder." Z

By the system of silo storage, the farmer will plant his whole crop at one time, and be able to cut it at the right moment of ripeness, irrespective of weather. The estimate of fodder to be produced from an English acre, by giving full benefit of fresh manure, is from 40 to 75 tons, according to the season, knowing the fact that the stalk at the time of its blossoming contains more

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Z What modifications has this grass undergone in changing into hay? These modifications are numerous. It is sufficient to cross a meadow when the new-mown grass is undergoing desiccation, to recognise that it is losing an enormous quantity of its substance that exhales in the air in agreeable odours, but which, if retained in the plant, would serve at least as condiments favouring digestion and assimilation. All stock-raisers know how rapidly young stock increases in weight in summer upon green pastures, and also that the same amount of grass converted into hay, and judiciously fed in winter, does not always prevent them from shrinking, and seldom gives any increase. The loss by desiccation in fine weather under the best conditions, added to that caused by the physical modifications, which render mastication and digestion of the hay more difficult than that of grass, and, consequently, assimilation less complete, merits the most serious attention on the part of those who are interested in agricultural affairs. Rains, and even dews, add immensely to the deterioration inseparable to a process of curing by desiccation. What agriculturist has not seen a hundred times his hay, notwithstanding the utmost care, injured by rain, and deprived of its richest and most assimilative elements?

nutritive value than at any other time. How foolish and wasteful to let it stand for the seed to form at the expense of the whole crop. The seed will not compensate for the loss sustained by the plant. The Great Master-Chemist, whose handiwork is seen in the tiniest leaf, allows those who care to study, to discover some of His laws, and those who have made progress to take advantage of the abundant store of nutritious food that surrounds them.

Mr. Thos. Easdale's letter in the *Field*, Dec. 30th, 1882 **(1)**, on silos, conveys a very clear and precise account of his experience with ensilaged grass, and I would wish to note that I do not approve of the use of the planks in weighting when such an excellent system as that of boxes exists. The planks prevent an equal pressure, whereas with the boxes every one does its work.

The quantity of salt is excessive, a layer on the top is found to answer best.

For grass it is not necessary to chaff or chop it, but for clover, tares, and rye it is better to do so.

The silo at Staplehurst was drained, but it was found quite unnecessary, if there is a roof over the silo to keep the wet out when it is empty.

"SILOS AND ENSILAGE."

(1) "My letter on this subject, which you inserted in your issue of the 16th inst., having brought forth very numerous enquiries from all parts of the country, including Scotland and Ireland, I find it impossible to answer them all by letter satisfactorily. Will you, therefore, again oblige by inserting the following series of replies in your next issue. I have endeavoured as far as possible to cover the various questions put; but am conscious that some of the points may require further elucidation.

Kind of grass used.—Commenced with ordinary grass from a roadside; then some of a stalky nature, and finished with strong aftermath.

State of grass when put in silo.—Some dry, other portions wet with dew, and other portions partially wet with rain.

How put in?—Thrown in with a fork, then shaken out, in order as far as possible to maintain a level surface; and the grass well trodden down.

How much put in at each filling?—Two feet depth, when trodden solid.

Use of the weighting apparatus.—After each filling, the planks and weights were put on with the greatest care.

Kind of weights.—The weights were the same throughout the whole operation—viz., wooden boxes, 12 in. square and 15 in. high. They were filled with puddled clay, and weighed 100 lbs. each. The boxes are placed close together, and always so as to cover the junctions of planks, but without any idea of their excluding air by overlapping or otherwise.

Covering boards.—1¼ in. thick; their length equals the breadth of silo.

Straw between planks and grass.—No straw or any other material was placed between the grass and the covering planks.

How long between each filling?—Three days, with the weights on.

Amount of sinkage.—Not yet exactly ascertained, but probably a little more than one-half; or, in other words, 14 ft. was put in, and the depth of the Ensilage now is 6 ft. 4 in.

Foreign substances mixed with grass.—From 14 lbs. to 16 lbs. of common salt was supplied to each filling, but no other substance of any kind was added to the grass. Whether the salt is actually necessary remains to be seen; and next year one silo will be filled without it.

If air-tight, and how?—No means other than the weighting apparatus were used to make the silo air-tight; nor was any attempt made in any way to hermetically close it.

Heating.—Not the slightest appearance of heating has been at any time observable in the mass.

Chopping of material.—This was dispensed with, because it would save labour and implement, and was considered unnecessary. We cannot think that any loss of space is occasioned thereby.

How long closed?—The silo was closed for 2 months and 11 days.

Colour of Ensilage.—The colour of Ensilage when taken out of silo was a "pale yellow green."

How much removed at once?—Just sufficient for a day's consumption is taken out of the silo at once, and no change of colour or smell has been noticed, even after being exposed for three or four days.

How left after cutting?—The silo is cut into for each supply, and the cut face left as you would that of a hay-stack.

Quantity of grass put in.—About 14 cartloads, *i.e.*, two at each filling.

What quality of grass should be used, and at what stage of growth should it be cut?—From experience here, we say, "the better quality the grass, the better the Ensilage," and, as the aftermath portion has come out as good as the other it should follow that grass of any age may be successfully used.

Other crops.—My neighbour intends to operate (in a second silo) next year on tares, oats, and *Prickly Comfrey.*

Material for building silo.—The walls (14 in. thick) of silo are built with good bricks and mortar, and faced with a coating of cement. The floor is made of bricks covered with cement.

Is the silo sunk or not?—The silo here is 8 ft. deep, 7 ft. of which are below the surface of the ground. Our experience has, however, suggested several important improvements.

How drained?—The silo was well drained all round and under, but not "into."

Should floor be level?—Give it a fall of 1 in. for its whole length, and at one corner of lowest end make a small shallow well, 9 in. square by 3 in. deep, from the bottom of which take a small pipe to a tap outside.

How covered in?—With a simple roof resting on the silo walls.

Cost of construction.—This can be easily ascertained, and would depend to some extent on local circumstances. There would be so many cubic yards of excavating, so many yards of brickwork and cement plastering, and, lastly, a plain substantial roof of some kind. It has been determined that the next silo erected here shall be roofed over, and an arrangement made whereby the weights can be raised and lowered with a block and pulley, so as to ease the manual labour. An improvement in the weights is also contemplated.

Cost of filling.—This will depend very much on how far the land on which the grass grows is from the silo. After this it is only a matter of carting to the silo and filling in as mentioned under heads 2, 3, and 4.

Ration for each cow.—From 35 lbs. to 50 lbs. per day, according to size of beast and quantity of other food given.

Quality of butter and cream and condition of cattle.—The butter and cream continue of the very best quality, while the improvement in the general appearance of cows is most decided.

Utility of the Silo.—It is obvious that silos virtually save the labour of hay-drying and stacking, and answer the purpose of a stacking barn. Moreover, they will, when fairly well-built, last fifty years or more; so that, practically, no future expense need be incurred beyond that of filling them annually.

Weight of Ensilage.—One cubic foot was put on scale to-day, and it weighed 43½ lbs., thus showing that our silo contained, when opened, rather over 10 tons. Comparing this with head No. 20 shows that little or no loss of weight can have taken place under the operation.

There can be no doubt of the great importance of this subject to every agriculturist, more especially to grass farmers. One of my correspondents in Ireland says that he and his father had 300 acres of meadow to save last summer; and, owing to the extraordinary wetness of the season, a great portion was lost. To such gentlemen silos will be the greatest boon imaginable. They can cart to them all the grass from shady and damp places round woods, &c., leaving that on the more open and upland places to be made into hay.—THOS. EASDALE.

ESTATE OFFICE, PEPPER ARDEN HALL, EAST COUTAN, NORTHALLERTON.

While the present book was in the press, my friend, Mr. Soman, of the *Norwich Argus*, sent me a full report of a very long and interesting lecture by Mr. Henry Woods, of Merton, in which he describes the experiments in ensilage made by Lord Walsingham, at Merton [the *Field* of 10th February gives this lecture almost in full], but I have only space here to notice the most important features of this detailed and graphic account of Lord Walsingham's doings.

The particulars given below refer to grass ensilage solely. Salt in the proportion of 2 lbs. to 1 cwt. of grass was used. No. 1 in the analysis refers to the two first silos, which were filled with grass taken from an oak wood, and such poor stuff that it was not considered worth cutting, even for litter. The 3rd silo was filled with rough meadow grass (No. 2 in the analysis).

The silos were filled in three or four days during dry weather, but dull and cheerless. The grass was carried direct to the chaff-cutters, put into the silo and well trampled down. When filled, wooden shutters were placed on the mass, and on this a bed of bran; the whole being weighted with stones, placed in skips of wicker-work for convenience of handling. Weight to each silo was estimated at 1½ tons, the silo containing 14 or 15 tons of cut grass. Three weeks after filling it had shrunk to about a third, and more grass was put in to fill up. The cost of filling, all expenses included, was 8s. 6d. per ton, or 12s. 9d. per acre.

After five months the 1st silo was opened and found in splendid condition; nicely moist, but without any superabundance of water. When first offered them, horses, cows, and young stock ate it greedily. Five pedigree shorthorn cows were selected and fed with this ensilage, and the following table gives the daily diet and yield from December 14th, 1882, to January 10th, 1883. Besides the proportions of ensilage and chaff, each cow had daily 6 lbs. crushed oats, and 3 lbs. bran. The milk previous to Dec. 14th was 68 quarts.

⅓ Ensilage, ⅔ Chaff.			½ Ensilage, ½ Chaff.			⅔ Ensilage ⅓ Chaff.			¾ Ensilage, ¼ Chaff.		
Date.	Milk.	Cream.	Date.	Milk.	Cream.	Date.	Milk.	Cream.	Date.	Milk.	Cream.
1882.	Qts.	Deg.	1882.	Qts.	Deg.	1882.	Qts.	Deg.	1883.	Qts.	Deg.
Dec. 14	70	13	Dec. 21	71	14	Dec. 28	72	15	Jan. 4	78	16
,, 15	70	13	,, 22	70	14	,, 29	72	15	,, 5	80	16
,, 16	70	13	,, 23	70	14	,, 30	74	15	,, 6	80	16
,, 17	70	13	,, 24	71	14	,, 31	74	15	,, 7	81	16
,, 18	70	13	,, 25	70	14	1883. Jan. 1	76	16	,, 8	82	16
,, 19	70	13	,, 26	70	14	,, 2	76	16	,, 9	82	16
,, 20	70	13	,, 27	71	15	,, 3	77	16	,, 10	82	16

It will be seen that when the month's trial concluded, the milk return had been raised by 14 quarts per day, and the quality of the cream to the remarkable extent of 4 degrees. These improved results correspond with the increased proportion of ensilage to chaff.

MILK ANALYSIS.

No. 1 sample was the milk of cows not ensilage-fed; No. 2 came from the five cows, the subjects of the above test. The following is the report of Mr. Francis Sutton, F.C.S.:—

	No. 1.	No. 2.
Pure fat...	2·76	3·11
Sugar, casein, albumen, &c...	9·37	9·82
Water	87·87	87·07
	100·00	100·00
Mineral matters (ash) ...	0·70	0·75
Specific gravity at 60°	10·30	10·32

This analysis is in favour of the No. 2 (ensilage) milk in every respect. Whilst in pure fat there was an increase of 0·35, and in sugar, casein, albumen, &c., of 0·45, there was a decrease of ·80 water.

It is a striking fact, says Mr. Woods, that two cows which had been fed with ensilage, on being deprived of the food for a couple of days, gave three quarts of milk less each day.

Analysis of the Ensilage.

Lord Walsingham, gratified as he might well be with the milk-pail returns of the cows, was extremely anxious to get as full and exhaustive analyses of the ensilage as possible, and Mr. Woods sent two sets of samples of the food to Mr. Sutton, and samples of hay made from grass of the same description as the ensilage, for the purposes of comparison. Nos. 1 consisted of ensilage made from grass described as grown in the wood, and hay from the same kind of grass. Nos. 2 comprised ensilage made from coarse grass grown in the meadow near the wood, and hay made from grass cut in the same meadow.

Analysis of Two Samples of Hay and Two Samples of Ensilage.

General Composition—Natural State.					Dried at 212° Fahr.			
	Hay No. 1	Hay No. 2	Ensilage. No. 1.	Ensilage. No. 2.	Hay No. 1.	Hay No. 2.	Ensilage. No. 1.	Ensilage. No. 2.
Water	22·20	24·90	74·30	65·95				
Soluble organic matter	8·21	9·75	6·24	9·17	10·55	13·00	24·28	27·00
Soluble inorganic matter	4·05	3·15	1·78	1·88	5·20	4·20	6·92	5·55
Insoluble organic matter	61·04	58·50	16·91	22·18	78·50	77·85	65·80	65·05
Insoluble mineral matter	4·50	3·70	0·77	0·82	5·70	4·95	3·00	2·40
	100·00	100·00	100.00	100·00	100·00	100·00	100.00	100·00
Detailed Composition—Natural State.					**Dried at 212° Fahr.**			
Water	22·20	24·90	74 30	65·95				
Albumen and protein substances, soluble in water*	0·73	0·88	1·60	2·12	0·94	1·17	6·22	6·23
Insoluble protein compounds†	5·03	7·09	1·41	1·43	6·46	9·45	5·49	4·20
Sugar, gum, and extractive matter, soluble in water	7·48	8·87	4·64	7·05	9·61	11·85	18·06	20·73
Oil, wax and chlorophyll, &c.	1·29	1·34	0·72	0·89	1·54	1·80	2·80	2·60
Digestive fibre	20·80	19·80	8·28	10·62	26·73	26·35	32·24	31·17
Indigestible woody fibre	33·92	30·27	6·50	9·24	43·74	40·25	25·26	27·14
Soluble inorganic matter	4·05	3·15	1·78	1·88	5·20	4·20	6·93	5·53
Insoluble mineral matter	4·50	3·70	0·77	0·82	5·78	4·93	3·00	2·40
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
*Containing nitrogen	0·115	0·149	0·255	0·336	0·149	0·186	0·992	0·990
†Containing nitrogen	0·755	1·120	0·221	0·226	1·020	1·490	0·860	0·665
Total percentage of nitrogen	0·910	1·260	0·476	0·562	1·169	1·676	1·852	1·655
Equal to total protein compds.	5·760	7·970	3·010	3·557	7·400	10·630	11·720	10·470

Abbreviated report of Mr. Sutton on the above analyses :—

REPORT ON THE ANALYSES OF HAY AND ENSILAGE.

County Analyst's Office, Eastern Counties' Laboratory,
London Street, Norwich, Jan. 17, 1888.

The two samples of hay consisted of a variety of grasses, many of them of a coarse description and of poor quality, and were destitute of the sweet smell and taste which always accompanies well-made meadow hay of good quality.

The texture of No. 2 was, however, preferable to No. 1, and the grass of a somewhat finer description.

Both specimens of Ensilage were, on the contrary, highly odoriferous from the development of the essential oils peculiar to the various grasses, and had also a vinous smell accompanied with a slight but pleasant acidity.

The smell of essential oils was so persistent that after handling the Ensilage for some time it became very difficult to remove the smell by washing.

The hay treated in precisely the same manner gave no trace of essential oils, or any flavour whatever except that of decaying grass.

The alcohol was estimated in No. 2 Ensilage, and amounted to 0.055 per cent. by weight, or about one-tenth of a per cent. of proof spirit.

These proportions are very small, and they arise, of course, from the conversion of a small proportion of saccharine matter in the original grass, but their development is open to no objection when kept within moderate limits; on the contrary, they add to the fragrancy and taste of the substance, and undoubtedly render it more acceptable and probably more digestible as a food.

If the effects of the silo were only to render what would otherwise be a tasteless, dry forage into a fragrant, appetising, and succulent food, it would be a decided step in advance; but the analyses will show that much greater changes of a beneficial nature occur during the process. These changes are especially shewn in the large proportions of soluble flesh-formers and fat-producers as compared with the hay.

For instance, in the case of No. 1 Ensilage, the soluble albumenoids (or flesh-formers) are increased more than six times, and in No. 2 more than five times; while, in the case of sugar, gum, and extractive matters, the proportion is nearly doubled in both instances.

The digestible fibre is also increased fully 20 per cent. in both samples of Ensilage.

These facts are of great importance, and well worth the attention of all stock-feeders, as it is evident that the occurrence of these nutritious constituents in a really soluble form is so much labour of mastication and digestion saved to the animals who are fed on such food, as compared with dry hay.

The change induced by the silo is, in fact, a partial digestion or limited fermentation; and undoubtedly such food will prove much easier of digestion and assimilation than crude hay.

In conclusion, it is abundantly evident, so far as these analyses can show, that the silo has produced a succulent, easily-digestible food, full of aroma and nutrition, from a very poor quality of grass,

FRANCIS SUTTON,
Chemist to the Norfolk Chamber of Agriculture.

Description of the Silos, by Mr. Woods:—

"We determined to convert one bay of a clay-built barn, at Merton, into silos. This is how we did it. Across the bay front we put up a 14 in. brick wall to within 3 ft. 10 in. of the tie beam, and two division walls of the same description, which gave us three silos, each 14 ft. 4 in. in length, 6 ft. 3 in. in width, and 9 ft. 3 in. in depth; the cubic space being sufficient for at least fourteen or fifteen tons of Ensilage; but there is no reason why two feet more brickwork should not be added to the height of the walls, so as to make room for three tons additional, or seventeen or eighteen tons in each silo. The barn floor was laid with asphalte some years ago, and therefore the silos required no new bottom. We covered the walls with cement plaster, composed of Portland cement and well-washed road silt, in the proportion of three of cement to one of silt. This coating, which was about half-an-inch in thickness, answered well in every respect, and showed, I think, that even clay-built barns are easily convertible into good silos. I ought to state that to prevent the brickwork being displaced in the filling process, a 2½in. plank, 14in. wide, was properly secured to the wall tops, and to facilitate the emptying of the silos, a well-made 1½in. boarded door, protected by a coating of hot tar, and pitch was inserted in one corner of the front wall of each silo. The frames of the doors were set on the inside, so that the doors opened inwards to the partition walls, and the apertures were hermetically sealed by means of 4in. brickwork on the front sides. The total cost of these three silos did not exceed £30."

In conclusion, I can add that the New York Congress for 1883 has met, and fully confirmed its former report in favor of ensilage in every way, and I can only add that I do not at all agree with the principle of screw pressure upon silos, because it is quite unnecessary, and in agriculture everything that is unnecessary should be avoided. I have shown by plates in this book, and I give my authority for it, that a simple hole dug in the ground will answer the purpose. I have also shown that the deeper the silo is, the better the ensilage that comes from it.

Further, if a farmer wants to try the preservation of fodder by this process, and has not a chaff-cutting machine, he can safely put in any material he has, and by following the rules I have given, obtain a good result.

The *Times, Field,* the *Live Stock Journal,* and several other important papers, are all according space for free discussion of the value of this system, and from what I can hear I am sure that it will become so generally adopted, that very few books will be required as a guide.

REPORT OF THE AMERICAN ENSILAGE CONGRESS, 1882.

From the " Weekly Sun," February 1st, 1882.

THE RESULTS OF SIX YEARS' TRIAL BY AMERICAN FARMERS.

Several hundred farmers and others interested in the subject of ensilage met at 57, Beekman Street on Wednesday to compare notes and recite their experience. Ensilage is the method of preserving green crops in pits called silos. It was first practised in France by Auguste Goffart in 1873. The first to try it on a large scale in this country were the Hon. Orlando B. Potter of New York in 1875, and Mr. Francis Morris of Maryland, who began in 1877. It is claimed that there are enormous advantages in this method of preserving crops, not only in the curing, but in the increased value of the product as food, because crops may be gathered in any weather, put away without drying, and all the succulent and nutritious juices of the food are preserved. Although the process is yet in a comparatively experimental stage, it has attracted much attention from farmers throughout the country. Specimens of green crops preserved in silos had been sent in by H. R. Barker, Lowell, Mass.; Robert Flagg, Fort Plain; Henry Lapham, Oconomonoc, Wis.; W. B. Eager, West Point, Nebraska; Albert A. Reed, Warwick, R.I.; Chas. S. Taylor, Burlington, N.J.; Francis Morris, Ellicott City, Md.; G. Morton, Essex, Vt.; John H. Gardiner, Norwich, Conn.; Frederick Loeser, Somerville, N.J.; Edwin Allen, New Brunswick, N.J.; C. W. Wolcott, Reedsville, Mass.; Benedict Brothers, Staten Island; E. W. Wright, Pleasant Mills, N.J., and the Massachusetts State Almshouse, Tewksbury. Samples of milk from cows fed on ensilage food were sent by H. H. Brown, Winterton, N.J.; N. B. Sinclair, New Jersey, and C. W. Mills, Pompton, N.J. Samples of butter were sent by Albert A. Reed, C. W. Wolcott, Francis Morris, W. B. Eager, and J. Y. Smith.

Mr. Reed brought a variety of samples, including corn fodder, and butter from cows fed on the contents of the silos. There were various other samples of such butter, some of which was pronounced as good as the best.

The sour and fermented smell of the samples of fodder caused general remark. It was asked if the fumes were not intoxicating. Mr. Reed said he had noticed one case where a calf had appeared to be made unconscious by the vapor from the freshly disinterred fodder. In appearance the crops which had been preserved by ensilage were about as green as when they were cut.

Mr. J. B. Brown, President of the New York Plough Company, who originated the meeting, welcomed the farmers. Among them were Orlando B. Potter, ex-Gov. Price of New Jersey, C. W. Mills of Pompton, N.J., Francis Morris of Maryland, M. C. Weld of New Jersey, Gen. Schuyler Hamilton, Edwin Allen of New Brunswick, G. H. Field of Peekskill, the

Rev. Dr. Ormiston, M. Benedict, of Benedict Bros., W. W. Merriam of Somerville, N.J., A. Maillard of San Rafael, Cal., J. N. Millbank, Col. Warren of White Plains, Col. J. W. Walcott of Canton, Mass., W. H. Field of Peekskill, John Crane of New Jersey, Charles V. Tatum of New York, and H. W. Stewart. Francis Morris of Maryland was chosen President, O. B. Potter, C. M. Mills, and ex-Gov. Price Vice-Presidents, and J. B. Brown Secretary.

RESULTS WITH VARIOUS CROPS.

Mr. Potter gave the results of his experience in preserving corn, rye, the grasses, sorghum, and, in fact, everything that can be raised in this State. He thought that RED CLOVER was, in most respects, the best crop for ensilage, because it settles in the most compact mass, and meets the principal requirement of the process, which is to exclude the air and retain the moisture. He believed that the best part of the crop would be lost by curing or drying. He found that when clover was properly preserved by ensilage, a piece about six inches cube would be a good ration for a cow, because it would be so compact. He believed that crops could be kept in the pits or silos ten years as good as the day they were cut. He had raised sorghum for three years, and found it a better crop than corn. It would produce more milk and flesh to the acre than could be got from corn, but would exhaust the soil more. In a favourable season he could get a pretty good second crop. He found that sorghum took a little longer than corn to mature.

Mr. Albert A. Reed of Warwick, R.I., said he had used ensilage two years with corn, grass, clover, sorghum, and rye, of all of which he presented samples. He had satisfied himself of the enormous value of ensilage by weighing his cows and their food and products, with and without ensilage. He presented statistical tables showing that the same cows, with ensilage food, would thrive and give better milk, and more of it. He showed a sample of sweet yellow butter, which he said was produced from the milk of a cow whose butter was white and insipid when she fed on other food. In one cow he increased the quantity of milk two pounds a day, and the butter was richer than before. He estimated that the cows ate about fifty pounds each of ensilage fodder per day. His statistics showed regular decrease in flesh and loss of milk when the ensilage food was withdrawn. He had let his sorghum go to seed before cutting, and upon taking it out of the ensilage pit he found it perfectly sweet. He let his cattle eat as much of the ensilage food as they would. When eating either ensilage or cured food he allowed his cows six quarts of bran a day.

"Did you notice any difference in the quantity of water that the cows drank?" was asked.

"Oh, a material difference," said Mr. Reed. Sometimes they would not drink at all. The food was so moist with the natural juices that they would not need water. I placed it where they could get it conveniently, and even warmed it for them, but they would not take much of it when they were feeding on this ensilage food."

Mr. Potter, in reply to a question as to the best method of sowing corn for ensilage, said he had tried both ways. If he could be sure that the wind would not blow it down, he would sow it broadcast. He did not think that as much to the acre could be raised where the planting was done with drills, but he found that it stood up under the wind better. He had tried all kinds of corn, and was, he said, dreadfully prejudiced in favor of sweet corn. He found that the mammoth sweet corn that he had raised produced the most milk.

CORN IN THE SILO.

Mr. W. M. White, of New York, said he had planted corn with drills in rows thirty-two inches apart, and got eleven tons and 200 pounds to the acre. He had tried sowing broadcast, and only got half as much as by drilling. He cut some of his corn three-eighths of an inch long and put it in his silo. After that he cut some double that length. The corn that was cut later was not so satisfactory in feeding. The corn that was sowed latest was most satisfactory when taken out of the silo. That which was older the cattle did not like so well. He approved of cutting the corn in a comparatively green state for ensilage. He managed to stow four tons an hour from the field to the ensilage pit very comfortably. He had fed as much as 100 pounds a day for one ration, but eighty pounds was better. In one case an animal gained 100 pounds in weight in forty-two days. He proposed to try a sixty-pound ration.

Mr. J. A. Hedges, of St. Louis, spoke of the necessity of machinery for cutting the heavy stalks of corn and sorghum. He had no doubt that American invention would supply the demand for new implements.

Chairman Morris suggested that there was great diversity of opinion as to methods of cultivation, and directed the attention of members to that point.

Mr. Van Houten intimated that the machinery and process of ensilage was expensive. He wanted to know how farmers could make it pay. He had heard the expense estimated at 30 cents a ton. He thought that was too much.

Mr. Goodwin, of Dutchess County, said he had planted corn with drills. Some of it had grown seventeen feet high, and the average was fourteen feet. This was Southern white, large corn. He had cut it with a sickle cutter about three-eighths of an inch long, and could put away a load of it in the pit for ensilage in fifteen minutes. He had four silos, or pits, about sixteen feet square and twenty-one feet deep, and covered the ensilage with 500 weight of stone. He estimated the cost of putting it in the silo at seventy-five cents per ton.

Mr. Van Houten—That's too much.

Mr. Wright, of New York, described his four silos. They were each 12 by 40 feet, and 16 feet deep. They held about 200 tons, and he had filled them in two days, using 16 men and 6 two-horse teams, costing him from 30 to 35 cents a ton for cutting and putting the crop in the silo. The crop was corn, planted about 32 inches apart. He got about 350 tons out of 40 acres, and planted with drills run by horse-power. After he got the crop in the pit he had the boys tramp it down, and then put on 100 pounds to the square foot. He showed a sample that had kept perfectly well.

"Do the cattle like it?" inquired a delegate.

"Yes, sir," said Mr. Wright. "I have 150 cows, and they will take all they can get."

"Do you feed it on the same day you take it from the silo?" was asked.

"I do, sir. It is my experience that it is best to use it on the same day."

"It is mine, that it is the best to feed it the day after," observed the Chairman.

Mr. Wright said further that he had never seen any ensilage food like that described by the inventor, Auguste Goffart, of France, which was said to be perfectly insipid, without perceptible odor. He referred to the samples present as proof that no such product had yet been secured by

American experimenters. He had raised only 350 tons on forty acres of land, but that was owing to the dry season. The year before he had raised fifteen tons to the acre, and several acres averaged twenty-five tons each.

"Did you weigh it?" inquired a farmer.

"I did not weigh it. I knew how much it was because I estimated it," said Mr. Wright.

Mr. Reed called attention to the uncertainty of statements as to the amount of crops not actually weighed or measured.

FIGURES ON THE COST OF THE PROCESS.

Col. J. W. Walcott, from Massachusetts, near Boston, said that last year he had raised 34 acres of ensilage crops. He had produced 460 tons, or a fraction over 15 tons per acre. He had planted corn in rows with drills operated by two horses and one man. His machine planted three or four rows at a time. He had read of 40 to 70 tons of corn to the acre, but he had not been able to get off more than 15 tons to 20 tons to the acre. He had raised corn 14 feet high. It made a great difference in the cost whether the product was 20 or 40 tons to the acre. He calculated that his crop cost $2.55 a ton. That included the cost of manure and everything else, including labor. He described his process of raising the corn. Then he told how he loaded the green stuff on his wagon and dropped it in his barn, ready to be run through the cutter and dropped into the ensilage pit. He employed about twenty-five men, and once a day he would get as many of them as he could, to get into the ensilage pit and tread the crop down, so as to get it compact. He had two ensilage pits, 50 feet long, 15 feet wide, and 21 feet deep, and had not been able to fill them. He could not raise corn enough to fill them, although his expectations had been so high that he had made provision to have his neighbour store his surplus. He had great confidence in the value of ensilage. He said he believed that on one acre of corn a cow could be kept twenty-four months. The way he would do it was to get two crops from the acre in one season. He raised a good deal of market garden stuff for Boston, and kept his twenty-five men pretty busy, but they found time to get on top of the silo, and tread down the ensilage crop for him. He managed to get his second crop planted on the same day that the first crop was cut for ensilage, so that there was not much lost time. He had tried ensilage with corn, clover, sorghum, and golden millet, and liked it very much.

Mr. Hicks of Queens County, L.I., said that in two hours' time his folks had cut up eighteen loads for ensilage. He spoke of dumping the load in the barn so that it needed to be lifted to the cutter.

Mr. Potter said he had got over that way of doing business long ago. He built his platform so that when the load was dumped it was even with the cutter.

Mr. D. Y. Smith of Doylestown, Pa., who, Mr. Brown said, was formerly employed by George Stephenson and later was in the Union army, gave the result of some interesting experiments he had made with ensilage. His pits were 26 feet deep, 40 feet long, and 16 feet wide, divided into four silos. But four of his silos were empty. He had managed to cut two rows of corn with a reaping machine.

Mr. Potter called attention to the fact that it costs less to gather ensilage crops because they do not need to be cured, and can be gathered in all weather. He estimated that clover could be kept in ensilage pits for half the cost of gathering when it was cured, and the ensilage clover would be a vastly superior article of food to clover cured in the ordinary way.

SIMPLE TRENCHES DO VERY WELL.

Mr. Wright, in discussing the question of cost of getting in the crop to the silos, said that would depend much on the distance of the silos from the field. The Chairman said he believed the time would come when the pits would be built in the fields. Mr. Potter said the cured clover required twice as much handling as the green clover used for ensilage. One great advantage was that a crop could be gathered in the rain and put into the ensilage pit wet without injury. Mr. Wright gave his experience in cultivating rye for ensilage. He said he had raised 9 tons to the acre, and found it inferior to corn. Mr. Reed said he had raised rye for two years, and averaged 5¾ tons per acre. It was 4 feet high.

A delegate, who had carefully calculated the matter, said that he found *one ton of ensilage grass to equal* 1,000 *pounds of hay.* Then there was a brief discussion as to the best cement to keep out the water from the silos. Gen. Hamilton spoke decidedly in favor of Portland cement or its equivalent.

Chairman Morris said that ensilage was in fact a very simple thing, but farmers seemed to think there was something mysterious about it because the words ensilage and silos were new to them. It was in fact a very simple thing. He made his silos by digging trenches 11 feet deep, seven feet wide at the bottom, and eight feet wide at the top. He did not line them at all. The water did not come in. When he had the pit filled with a crop he put a covering of felt on it, and covered it with dirt as a weight. He used salt at first to put on the crop as it went into the pit, but he found that was unnecessary. The soil was marly clay. He did not think there was any necessity for building a wall of stone and cementing the pits, as some did. He found his trenches to answer all purposes and should build more in that way. As for brick walls, he said everybody knew they could not be made either air-tight or water-tight. He did not find that the rain penetrated his covering of earth and felt. He found no difficulty in moving his cutter from one silo to another. The average shrinkage was one-third the bulk.

Ex-Gov. Price, of New Jersey, said that agreed with his observation of the silos belonging to Mr. Havemeyer, in which the ensilage crop had shrunk about one-third.

The delegates discussed various methods of pressing down the crop after the pit was filled. Some used boards covered with stones. Some used cloth covered with earth. One man used barrels of vinegar. Another used screws, but could not get his men to keep them tight, the crop packed so rapidly.

HOW MR. MILLS MANAGES HIS SILOS.

Mr. C. W. Mills of Pompton, N.J., gave a long statement, and submitted to a protracted cross-questioning on the subject of an independent discovery which he claims to have made in 1879, which makes the process of ensilage cheaper than before. He abolishes altogether the expensive pits built of stone or brick and lined with cement, the cost of which has frightened many farmers. He claims that all that is necessary is that there shall be a slight wooden frame, not necessarily air-tight, to prevent the spread of the ensilage crop when the weight is placed on top. He has built silos and used them, but says he will never build another, because they are unnecessary. He estimates that he puts on *about* 300 *pounds pressure to the square foot.* This is applied on the top of blocks of wood about four feet square. When he wants to take out his crop he takes off one block and cuts out that much in a solid chunk. He says the pressure is sufficient to keep the air out of the sides of the crop, and that the product is kept even better than in the silos, where it is too often bruised and battered until the succulent juices depart and are replaced by useless and harmful bubbles of air. His theory is that of uniform and continuous pressure. He said he could sustain *eighty milking animals six weeks on the product of five acres.* His plan was to get it into the silos quickly and cover it immediately. He fed his animals with three quarts of grain a day and thirty pounds of ensilage food. He planted his corn in hedges about thirty-two inches apart, putting in forty or fifty kernels, instead of five or six, as usual. The growth was principally stalks, very sweet, with hardly any ears, and splendid food that could be cut very green. He had used an old-fashioned mower to cut the crop from the field. He estimated the cost of harvesting at seventy cents a ton, but said *he would rather have one ton of that crop than a ton of the best hay.* He estimated that he had raised 700 *tons on twelve acres.* Upon being questioned, he admitted that he had neither measured the product nor the land, but he protested that his estimates were accurate. When his crops were cut the corn was perfectly green at the top. He spoke with emphasis against feeding on any unripe product, and for that reason opposed raising ears of corn to be cut green. Such unripe food, he said, was poisonous. Even clover was, in his opinion, poisonous to cattle if cut before it blossomed. The corn he favored most was Southern horsetooth corn. He was careful to get seed from one locality, so that it would all ripen together. He spoke of the necessity of keeping the surface of the ground broken, so that when rain fell it would soak in, and not evaporate, taking the best of the manure with it. Under a fire of cross-questions, he described his method of putting weights on his crops in ensilage, and said that the great principle was to keep the air excluded.

Mr. Potter said that his experience was that it was useless to have silos built above ground. He had tried it to his cost. That part of the crop contained in the part of a silo above ground was found spoiled on several occasions. He had given the matter a fair test, because the silo was built in the side of a hill. He had found no such difficulty with the silo all under ground. He based his judgment on two years' experiment with one silo. He had found that the best weight on the silo was earth. Even where the earth touched the crop the ration would be eaten. Sometimes he had put on a layer of hayseed. He found that a layer of earth would follow the most uneven settling, and thus keep the mass compact. He thought that with one foot of earth he would get as much weight as Mr. Mills.

Mr. Mills—Oh, no.

Further discussion was participated in by Mr. John Payne of New Jersey, Mr. Riker of New Jersey, Mr. Reed of Rhode Island, Mr. Smith, Mr. Mills, and Mr. Brown of Orange County, whose silo pit cost him $2,000. The Congress then adjourned until yesterday morning.

WEIGHTING HEAVILY TO EXCLUDE AIR.

Upon the reassembling of the Congress yesterday a letter was read by J. B. Brown from Senator Warner Miller asking about the weight necessary to place upon the silos in order best to preserve the crop. Mr. Smith, of Doylestown, gave it as his experience that the ensilage was most perfect where the weight put on was greatest. He had noticed in one silo that where the weight was lighest the crop was not so good as in another part of the same silo, where the weight was heavier. Chairman Morris said his practice was to first weight down the silos with heavy stones placed on planks. Afterwards he covered the silos with a foot of earth. Mr. C. W. Wolcott of Reedville, Mass., said it was his belief that a heavy weight was best.

Mr. John P. Kennedy, who has in Putnam County one of the best silos in the country, gave an account of his experiments. He had built his silos of stone, made air and water-tight with Portland cement. His cutter was run by steam at 1,050 revolutions a minute. He cut corn as fast as two men could spread it in his silo, and kept a horse treading it down. He packed it tight to exclude air. His neighbours were incredulous, and said that "Kennedy had plenty of money and was spending it." He opened his silo in September and found the crop in perfect order, and, although the crop was moist, the floor was dry. He attributed his success to perfect packing and exclusion of air. He gathered about 1,500 to 1,800 pounds in the field in each load, and could cut such a load in four minutes and drop it into the silo. He had rigged an arrangement over his silo so that two men could get out enough fodder for 100 head of cattle in an hour. Summing up his experience, he said:

"The secret of this thing is packing. If you have no air you will have no oxygen and no fermentation. I kept my crop well packed in the silos. I locked up a horse in one of the silos, and let him walk about there three nights."

"I don't think it makes much difference how we do it, so long as we exclude the air from the crop in the silos," observed Chairman Morris.

"It makes a good deal of difference which is the cheapest," replied Mr. A. H. Reed.

RESULTS AND EXPENSES.

Mr. J. B. Brown read a letter from E. M. Washburne of Lenox, Mass., who had fed milch cows on millet, preserved by the ensilage process, at 13½ cents a day the cow. The stock improved, and the milk was better. He was satisfied that the ensilage process was the best method of preserving food. Mr. Brown also read a letter from Harrington Brothers of Worcester, Mass., who had fed fourteen horses on ensilage food. The horses were used in a livery stable, and had no other food.

A letter from Dr. Wm. B. Eager of Nebraska, formerly of New York city, gave a detailed account of his method of raising corn for ensilage and placing it in the silos. He found the cost to be 92 cents a ton for the crop as it stood in the silos.

Mr. C. W. Wolcott read accurate statistics of his expenses and receipts for thirty-two acres. The actual cost of corn raised for ensilage was $2.55 the ton as it stood in the silos.

In the course of the discussion as to feeding, Mr. Mills spoke of the great value he had found in feeding horses with ensilage food. A member of the Congress asked:

"Did you lose any horses?"

"Yes. I lost a whole stableful of horses," said Mr. Mills, "but it was not because they were fed on ensilage food. The reason was that one of my men took one of my best horses to go to Paterson to see his girl. He put up the horse in a car-stable, where it got diphtheria and gave it to all my other horses. It was not the ensilage food that killed them. My horses that were fed on ensilage food did not die."

Mr. Reed called attention to the necessity for accuracy in measurements of land and product in giving accounts of results. He gave some amusing incidents of the mistakes made, even by conscientious old farmers, in guessing instead of weighing. He had one field which was estimated to have 125 tons per acre. The actual measurement was sixteen tons per acre. In another case a farmer estimated that he was drawing loads that weighed two tons, but the actual weight was 1,500 pounds.

Mr. Potter gave it as his experience that the ensilage food could be cut out and left lying exposed about a day while feeding. He made an experiment with fifty-six cows, who, when fed on ensilage food, thrived and gave more and better milk than when they were fed in good pasture. He called attention to the advantage of keeping cows in the house in cold weather. He described his silos, and said that he had built them so that his stable was below the silo, and the food was easily taken out. He built his silos so that they were air-tight. He got pressure by covering the crop in the silos with brewers' grains. That gave some weight on the crop. He had not paid much attention to the matter of weight on the silos. He had aimed to fill his silos quickly, exclude the air, keep the crop at an even temperature, and mix the crops as well as he could. His results had proved very satisfactory, and he had little loss by spoilage. What he had heard had convinced him of the necessity of trying more experiments with weights on the crops in the silos. He believed that the crops would pack much better when mixed.

CORN PACKED WITHOUT CUTTING.

"Here's a bombshell thrown in our camp," said Mr. Brown, holding in his hand a small sheaf of corn that had been preserved by ensilage without being cut. Mr. W. R. Strong of Golden Bridge, N.Y., gave it as his experience and belief that corn could be preserved without cutting; that the more it is cut the more it is injured, and that the natural protection which nature places about the corn is the best. Mr. Mills corroborated this to some extent as the result of his experience. He said that there were various methods of preserving crops by ensilage. The air could be excluded either by Mr. Potter's plan of hermetically sealing the silos, or by pressure. He favored the latter plan. Mr. W. R. Strong also preferred exclusion of air by pressure.

Mr. J. Y. Smith said he had seen pits for brewers' grains opened in London which had been closed for nine years, and the grains were as good as they were when put in the pits. He was satisfied that it was best to cut the corn before feeding it, as the cattle were thus saved a good deal of work. Since the cutting could be done for twenty-five cents a ton, he thought it most desirable that it should be done.

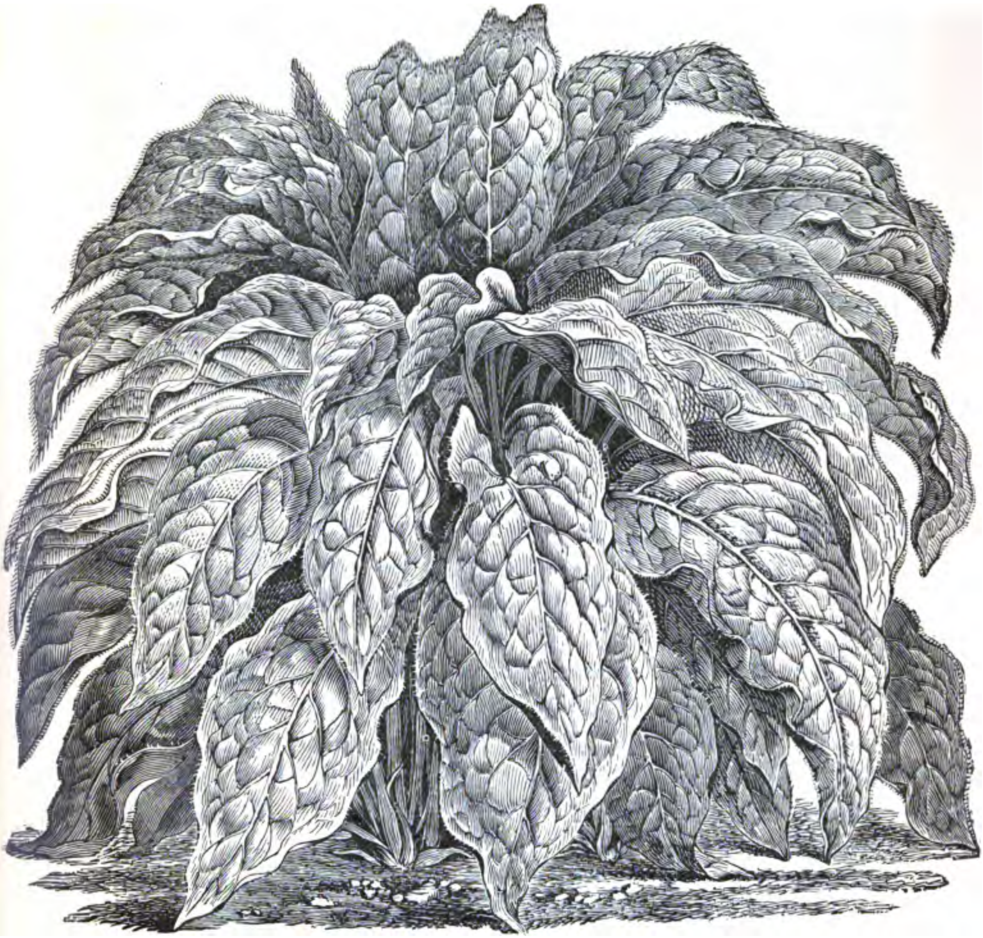
The Rev. Dr. Ormiston made a vigorous and telling speech, and kept the Congress in great good humor. He said he was going to preach religion on Sundays and ensilage the rest of the week. He thought the best way to spread the knowledge of the subject would be to let the farmer know that he could make money by it.

CONCLUSIONS AFTER SIX YEARS' TRIAL.

The following resolution was adopted on motion of Mr. J. B. Brown:

Resolved, That it has become a well-established fact by six years' successful use in this country, and by the concurrent testimony of many intelligent farmers, that the ensilage system is of great advantage to the farming interest, as to all mankind.

The Congress then adjourned for one year.



CAUCASIAN PRICKLY COMFREY.

When in 1877 I published my first edition of Forage Plants, and gave coloured illustrations of the genuine *Symphytum asperrimum* in full flower, the plant was (although not new to England) a very strange one in the eyes of our English farmers. The point I had to enforce in 1877 was its usefulness as a forage plant; for farmers, not having grown it or seen it grown, made quite sure that cattle would not eat it. This idea is pretty well exploded, it is true, but the warnings I then gave as to the necessity for great care in buying roots, are as necessary now. Any quantity of Comfrey, wild, useless stuff, having purgative properties instead of being a nourishing food, is still hawked about and sold to farmers at low prices. It is this bad Comfrey—*S. officinale* principally, which occasionally being purchased and planted by an unfortunate experimentalist, leads to the name of Comfrey becoming an abomination in the eyes of an entire district. All those, however, who have the genuine variety praise it, and largely extend their cultivation of it. Like other plants, it requires some little knowledge to extract its full benefit, and certain modes of treatment must be avoided. For instance, after flowering, Prickly Comfrey well deserves its name of prickly, and if then offered to cows or animals for the first time, they will, in nine cases out of ten, refuse to have anything to do with it, merely because it hurts their mouths. If required as green forage, cut it just as it shows for flower, when the prickles are scarcely perceptible, and it is exceedingly succulent. If by chance some plants have gone ahead, flowered, and got a little too tough and prickly, cut them down with your sickle, and leave them on the ground for a couple of days. The prickles become flaccid, and cattle then eat the food readily.

I have not here space to give all the mass of correspondence which I have received in favour of growing Comfrey, and some of which appeared in my first edition. I must select two or three brief extracts; and, first, I give the opinion of Mr. J. A. Barral, Perpetual Secretary of the Central Society of Agriculture in France *(Societé Centrale de l'Agriculture en France)* who writes in the *Journal de l'Agriculture,* of 7th October, 1876 (No. 391):—

> "Two sets of *S. asperrimum* put late into the ground, in the month of May, in a fairly deep soil, but of poor quality, gave on the 29th Sept., the one—a cutting of 3.250 kilogs, and the second—a cutting of 1.850 kilogs. The height of each plant was 40 centimetres, diameter 85 centimetres. Two cows to which we offered the leaves, freshly cut, ate them at once, in spite of their roughness. The quantity of water is 88 per cent., and the proportion of Azote (Nitrogen) 0·4 per cent. in the green state, or about the richness of green maize. The total of nitrogenous substances is about one-third, a remarkable richness, which justifies the high opinion that cultivators, who have tried it, have formed of the plant.
>
> "We will not further insist upon the healing properties which it is said Comfrey possesses, but as the quantity of green forage obtained per hectare, in a soil deep and moist enough for vegetation, appears to rise as high as 300,000 kilogs per hectare, and perhaps more, it is certainly a plant to be tried, particularly for "pitting" purposes (particulièrement au point de vue de l'Ensilage), in order to provide green food for cattle throughout the winter."

Prof. BUCKMAN, F.L.S., F.G.S., kindly furnished me with a long report on Comfrey, which I published at length in Forage Plants No. I., but must content myself here with giving a few brief extracts. He says:—

> "The sets grew rapidly, and we were soon enabled to divide them into more than a hundred individuals, which were planted in like manner, and so working on until we had as much as a quarter-of-an-acre of ground occupied, and our crop was not only abundant, but some of the stems were a considerable height, some few having been left to show its mode of growth.
>
> "The rest, however, was used in various stages of growth as cattle food, though we must confess to having experienced no little disappointment on our first trials, yet no sooner did the cows (especially milch cows), horses, sheep, and pigs begin to understand it, than they eat it most greedily, and our report upon it was that while all creatures seemed to thrive upon the Comfrey, yet in no instance could we find the slightest evidence of any evil effects.
>
> "The crop was enormous, and this, too, upon land of very medium quality; but we have this year been trying its growth on light sandy soil, and can report that all through the season of drought the thick deep roots of the Comfrey have drawn up the moisture which rises hygrometrically in our sand bed, and the result has been a succession of green leaves when surface plants were an utter failure.
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> * * * * * * *
>
> "From our own practical experience, we conclude that we have in the Comfrey a plant capable of conferring great benefits on the farmer, at the same time it must be confessed that, like wheat or potatoes, there are different sorts of this plant, and one sort is better than another."

I had, long before receiving Prof. Buckman's report, found out for myself that some plants produced far more green top than others, and had also noticed two singular facts—that in certain plants the root and flower stems grew almost solid—so much so that cuttings from the flower stems could be propagated like geraniums. Working in this direction, I soon had a large plot of these "solid-stem" plants, and then this second curious feature came to light. Animals and birds fed far more readily on these improved plants than on the others. This fact is brought out very prominently in a letter which my friend, Henry Doubleday, has sent me on the subject of Russian Comfrey, and which I print further on. Having ascertained and proved in this way the advantage of starting with good stock, I at once set to work to get the best and purest possible. I imported roots direct from St. Petersburg, and these I have carefully grown, and in every way they have proved superior to anything before known in this country as Prickly Comfrey. On good heavy soils, Russian Comfrey is fully equal to giving from 120 to 150 tons of green forage to the acre, from plants placed one yard apart each way. Henry Doubleday states that so much do animals prefer what I have called the Russian variety of Comfrey, that they positively, when turned out in the morning, will pass by beds of *S. asperrimum* to get to the richer and more tasty Russian sort.

The only satisfactory way of propagating the plant is by "sets" or cuttings. Seedlings are sometimes raised, but are very difficult to grow, and my experience is that collected seed is utterly worthless, but that self-sown seedlings often do well and make good plants.

Comfrey is especially a good green food for horses. It will make their coats shine in a wonderful way, and at the same time keep them hard; they are excessively fond of it. Rabbits may be given Comfrey *ad libitum*, and never suffer from a surfeit of this splendid green food. Cows often want tempting at first to induce them to take to Comfrey. It often has to be cut up for them or, better still, *left to wither on the ground, after cutting for a couple of days.* The aroma of dried Comfrey is superior to that of the finest clover hay. Where a large enough plantation exists, if a small stack of dried Comfrey be used to flavour any inferior quality hay from bad pasture or badly cured, I doubt if ever again the Comfrey stack will be absent. A handful of it will scent a large quantity of otherwise flavourless hay.

With the system of Ensilage (so fully gone into in an earlier part of this book) known and accepted by Englishmen, there is no doubt but that plants of quick growth and heavy yield will soon come to the front. I am evidently not alone in this opinion, as may be seen from this letter which I copy from the *Times* of Oct. 24th, 1882:—

> The very graphic description given by your correspondent in the *Times* of to-day of the silo and Ensilage as they exist in Europe and America will greatly interest many English and Scotch agriculturists who are puzzled in determining what to do with their green crops when in excess of consumption or when the weather forbids their ingathering.
>
> I observe that no allusion is made to prickly Comfrey, which is now found to be one of the most productive crops grown in this and other countries, and which, when cut and mixed with dry chaff, forms an excellent fodder for all kinds of stock, though it is not preferred by cattle or horses in its natural or growing state.
>
> Permit me to draw attention to this omission, and thus indirectly to speak of a valuable foreign forage plant (*symphytum asperrimum*), which affords four or five cuts in the year, weighing, in the aggregate, as much

as 100 tons per acre, and which appears to be singularly fitted for the silo. In fact, the extraordinary bulk of cattle food which may be gathered from it would suggest its special growth as an ingredient of Ensilage.

Yours faithfully, J. BAILEY DENTON.

22, WHITEHALL PLACE, LONDON, S.W., Oct. 20.

Mr. Goffart finds that he can ripen maize quite sufficiently for purposes of Ensilage, and it must be borne in mind that any crops like rye or anything with much straw, want something of the nature of clover or Comfrey to help them to solidify and form a mass. When intended for the silo, Comfrey should be allowed to come into full flower before cutting.

"Dear Friend,—I hope by this time the notion that animals do not eat Prickly Comfrey with a relish, is quite abandoned by those who entertained it. At any rate, it can no longer exist where Comfrey of a genuine variety has been fairly tried. Of course, as they would with any other new food, animals eat it at first with a degree of caution, on account of the roughness of the leaves, which disappears when they become a little withered. This is a natural instinct which, fortunately, they possess, or they would soon be poisoned by eating deadly plants. Animals form a better opinion than we can give them as to the good effects, or otherwise, of food given them, and will refuse that which acts injuriously. After they have so proved the Prickly Comfrey, they become extremely fond of it, and thrive upon it. I have at this time three cows and a splendid Russian cob which are fed entirely upon it, with the addition of a small quantity of bran, and a few grains for the cows; I only give one bushel of these latter per day for the three animals. The cows are in splendid condition, and yield a large quantity of milk, and are quite a match for those fed in pastures and at much greater cost; and as for the Russian cob, several good judges have said they never saw a finer specimen of his breed, or in better condition; and this is as it should be, for as the pedigree of this cob is Russian so it has been fed with Russian Prickly Comfrey. This splendid Comfrey, which I now grow almost exclusively, I find a stronger growing plant, being much larger, both in stem and root, than the old variety; and I find also that animals prefer it. When young, and before it blossoms, it is very delicious, and it looks so tempting, with its broccoli-like heads, that I gathered some and had them cooked as a dish of broccoli, and really found them very good. As they come in early in April, they may prove a valuable addition to our spring vegetables.

I have taken considerable pains to ascertain the weight per acre this variety will grow, and I have not only weighed the produce per rod, but each plant upon the rod tested. There were 54 plants, and I have put down the weight of each plant cut. I have done this for the purpose of showing the weight that might be grown per acre as well as that which I grew in this particular instance, because there is no reason why we should have so great a difference in the weight of each plant. In the following tables I have put weights of the first and second cutting:—

ONE ROD CONTAINING 54 PLANTS.

Weight, in pounds, of each plant, cut 30th of April:—

10, 7¼, 7¼, 5¼, 5¼, 6, 4, 5, 6, 6, 6, 4½, 5¾, 5, 3¾, 4¼, 3½, 2¾, 3, 2¾, 3½, 3½, 5, 3¾, 4, 3½, 2, 7¼, 3¼, 5¼, 4½, 4, 4, 3, 3¼, 3, 2¾, 3¼, 4½, 4½, 7, 4½, 2½, 3, 2¼, 2½, 2, 1¾, 2½, 1¾, 1¾, 1¾. 2, 1¾.

Total weight per rod, first cut, 218.

The second cut was on the 16th June. Weight, in pounds, of each plant cut:—

10½, 3½, 2½, 5¾, 5¾, 1½, 7½, 5½, 5½, 3½, 3, 4¼, 2, 4¾, 2¾, 2¾, 1½, 5¾, 6¾, 1½, 2, 5¾, 4¾, 5½, 3, 2½, 2¼, 1¾, 3¼, 5¾, 6¾, 1, 3¼, 2½, 4¾, 3, 5, 3¾, 2½, 2½, 9, 4, 3¼, 2¼, 5¼, 4½, 6, 6, 6½, 2½, 8½, 4¾.

	Cwt.	qrs.	lbs.
Total weight per rod, second cut	2	0	2½
” ” first ”	1	3	22
	3	3	24½

This is equal to 31 tons 15 cwt. per acre for the first two cuts, and we might make a very fanciful calculation of the weight per acre supposing that all the plants had been of the larger weights in lieu of so many smaller ones; but a fair estimate may be taken from these figures, calculating from four to six cuttings per annum. I have chiefly grown it upon a stiff clay, what is commonly called a good pipe and tile earth; but I have also grown it upon land of a lighter description, but not what is called a light soil, and have found very little difference in its growth upon the two or three different soils. In all cases I have found that good cultivation and well manuring tells more than the difference of soil.

I have paid particular attention this season to making it into hay, partly from having such continual enquiries as to the best method of doing so, and also from the more personal motive of the fondness for it of my cows and cob, and I have found the most simple way of so doing, is to cut it with a sickle, and lay it as cut in small heaps; let these lay about a week, turning them once; then put the whole into small cocks, and let them remain two weeks, opening them once or twice; if the weather has been favourable it will now be in good order for stacking. I have followed this course the present season, and have a stack of excellent hay. No farmer, I think, would be able to distinguish it from clover hay, judging by its sweet smell.

I have also just made a profitable experiment in fattening calves. I had one killed yesterday, ten weeks old, which has turned out extremely well. Calves are very fond of Comfrey leaves, and I allowed them to eat it pretty freely, which effected a considerable saving in the quantity of milk required for fattening. I think this is a fact of some importance, and I shall give more attention to it.

Russian Comfrey is the quickest grower of any I have met with; of course you must not expect it to do much the first year of planting, though this exceeds all other varieties in that respect, but the second year we get a heavy crop, and the third a still larger, and it continues to increase. Those named in the tables had only been planted two years, and, as will be seen, one plant yielded 10 lb. weight at each cut, and at the second cut was four feet high, and four feet in diameter, or spread of leaf. I think we have yet much to learn, especially in the use of the hay, and I shall continue to give my best attention to it. Anything in the present depressed condition of the agricultural interest that holds a prospect of profit is, I deem, worthy to be investigated, and I think I can show that feeding with the New Russian Variety of Prickly Comfrey is a paying concern. My cows consume daily about 130 lbs. each of the Russian Comfrey, so that the consumption per week is about 1¼ tons for my three cows and pony, and as it can certainly be grown at a profit of 10s per ton, it is easy to see there is a good margin for profit.

H. DOUBLEDAY.

COGGESHALL, ESSEX, *4th July, 1882.*

MENTHOL.

Mentha Arvensis, f. piperascens.

I HAVE for the last four years tried to get seeds and plants of this important herb or drug, but was not successful until last year.

With the small stock of roots that I then imported from Japan I have been enabled to place before the Pharmaceutical Society, and most of the museums of Europe, specimens of the dry herb, with the fresh flower, root, and seeds, for comparison with other varieties of mint.

They have decided upon its name, and I have propagated it largely, because I am sure it will prove one of the most important plants introduced into this country for some time. It may not be known to many of the readers into whose hands this book may fall, that this plant yields the crystalline substance called "Menthol," now pretty generally used by the Medical Profession, as it has been proved to cure bad cases of neuralgia and sciatica, and affords immediate relief in cases of headache, toothache, and coup-de-soleil.

My attention was first called to the value of this plant by my Chinese servant curing me from an attack of sunstroke in China, in 1852, with this drug.

In old times the cattle used to range over meadows, and upon the sides of hills, upon natural grasses containing any number of wild herbs. Cattle are imbued with most wonderful powers of instinct, and there is not the slightest doubt but that when they have the chance, they search out certain herbs and grasses, giving sometimes the preference to one variety sometimes to another.

Sooner or later it will be found advisable to sow in pastures under the control of wealthy proprietors the seeds of herbs known to be good for cattle, and not to depend entirely upon grasses. The time for cutting these herbs will be when they are just coming into flower. At that stage of growth this year I cut the stems from my plants of Menthol in my garden at Sydenham, and upon opening the lid of the box a few weeks afterwards, I was quite amazed at the powerful aroma from the dried leaves, and I am quite sure that no garden ought to be without it. It will pay well for any one to propagate who has light and strong soil to grow it upon. It is quite hardy, and exists in the open air throughout the winter; the distillers will buy it for the oil and camphor, which is now worth 12s. 6d. per lb., and the crystal Menthol, which fetches 10s. per lb.

THOMAS BIGG,

Agricultural and Veterinary Chemist,

By appointment to H.R.H. the late Prince Consort, K.G.,

Leicester House, Great Dover St., Borough,

LONDON,

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Sheep-Dipping Composition

For the Destruction of Ticks, Lice, &c., and for the Prevention of Fly, Scab, &c.

Also for his SPECIFIC or LOTION, for SCAB in SHEEP, or MANGE in HORSES or DOGS.

It is only necessary, in giving orders, to state the number of Sheep, to have the right quantity for each sent.

DIPPING APPARATUS, £4, £5, & £16 each

Important Certificate from Mr. Herepath the celebrated Analytical Chemist.

BRISTOL LABORATORY, OLD PARK, 18th Jan., 1861.

SIR,—I have submitted your Sheep-Dipping Composition to analysis, and find that the ingredients are well blended, and the mixture neutral. If it is used according to directions given, I feel satisfied that while it effectually destroys vermin, it will not injure the hair roots (or "yolk") in the skin, fleece, or the carcase. I think it deserves the numerous Testimonials published.—I am, Sir, yours respectfully,

WILLIAM HEREPATH, Sen., F.C.S., &c., &c.

To Mr. THOMAS BIGG. *Professor of Chemistry.*

Catalogues Free on Application.

AGENTS IN ALL PRINCIPAL TOWNS.

CAUCASIAN PRICKLY COMFREY

"While all creatures seemed to thrive upon the Comfrey, yet in no instance could we find the slightest evidence of any evil effects."—*Prof.* *BUCKMAN, F.L.S., &c., &c.*

SYMPHYTUM ASPERRIMUM, or CAUCASIAN PRICKLY COMFREY

Sketched from nature at the Royal Botanical Gardens, Kew, November, 1875.

RUSSIAN COMFREY.

This pure stock of imported Symphytum Asperrimum yields the largest crop of green fodder known. It will grow luxuriantly on rank clay, and well on light soils, if of some little depth. For Milch Cows, Horses (especially Hunters), and all animals, it is the best of green foods. Its use makes the coats of Horses shine, and keeps them hard and in good condition, saving all medicine. Being a Perennial, once planted there is no further expense. Autumn or early winter sown sets are the best, as the leaves will appear before the grass can be fed off in the spring. For winter keep, it can be preserved by the system of "ensilage" or pitting (see "Forage Plants.")

To the Editor of the "Times," Oct. 24th 1882.

Sir,—Permit me to draw attention to this omission, and thus indirectly to speak of a valuable forage plant (*symphytum asperrimum*), which affords four or five cuts in the year weighing, in the aggregate, as much as 100 tons per acre, and which appears to be singularly fitted for the silo. In fact, the extraordinary bulk of cattle food which may be gathered from it would suggest its special growth as an ingredient of Ensilage.

Yours faithfully, J. BAILEY DENTON.

22, Whitehall Place, London, S.W., Oct. 20th.

The reduced price for fine selected Crowns this Season will be per 1000 Crowns, £5; per 100 Crowns, 12s.

Orders of £5 in value (if accompanied by a remittance) sent Carriage paid.

It will produce from 100 to 150 tons to the acre the third year on a favorable soil.

THOS CHRISTY & Co., 155, Fenchurch St., London, E.C.

MENTHOL CONES.

Instantaneous Relief for

HEADACHE, TOOTHACHE, or NEURALGIA.

SUCCESSFULLY used in the severest cases of Nerve Pain. For Neuralgia it is particularly advocated as a local remedy, until constitutional treatment has had time to take effect. It possesses a great advantage over Aconite, Morphia, Veratria, Chloral, and Atropia, &c., as it is NOT POISONOUS, while its exceedingly powerful taste and odour are sure to prevent its being swallowed in quantity sufficient to cause irritation.

DIRECTIONS FOR USE.—Rub the end of the cone gently over the part of the head or face where the pain is. The first application will afford relief. The smell is very pleasant, and a Cone will last for many months.

The following appeared in the *Edinburgh Medical Journal*, from Mr. A. D. McDONALD, viz.:—

> As an anti-neuralgic, menthol is of great value. One-tenth to one-sixth of a grain of menthol steadies the contractions of an excited heart, and slows them to a comfortable speed, and at the same time produces slight cerebral drowsiness. . . . . In the first case, tri-facial neuralgia, the affected tract was painted with a mixture of menthol. This was done four times in successive attacks. Entire relief followed in from four to six minutes. First a feeling of coldness, and then some irritation from the application was experienced. Its use in toothache is followed by immediate relief. In neuralgia it has been noticed to render the paroxysms less frequent and less severe. In sciatica, the author painted the track of the sciatic, popliteal and tibial nerves to the ankle-joint with a 10 per cent. solution, and this gave the patient immediate relief.

In the *Pharmaceutical Journal*, Nov. 15th, 1879, Mr. A. H. MASON, F.C.S., says:—

> A few years ago my brother-in-law brought with him from China some bottles of *Po-ho-yo*, which he said was used out there as a specific for headache, and as he happened to call when I was prostrate with a severe nervous headache, he insisted upon anointing my forehead with this magic liquid. I immediately experienced an agreeable burning sensation, and perceived a powerful odour of peppermint, fell asleep and awoke minus the headache. When I smelt this liquid menthol, I fancied I recognised my old restorative, and I should not hesitate to apply it—of course, diluted—should occasion require.

MENTHOL CONES 1s. per CONE.

Menthol, Chloroform and Chaulmugra Mixture, 2s 6d per Bottle.

Recommended for cases of Rheumatism or Pain in the Limbs.

Ask your Chemist to get a supply of Menthol Cones (Christy & Co.) from his London Wholesale House.

MENTHOL PLANTS.—We can now offer these to Agriculturists here and abroad at 2s 6d each, 18s per dozen, or £5 per hundred.

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FORAGE PLANTS and their Economic Conservation by the New System of "Ensilage."—Caucasian Prickly Comfrey and other Forage Plants, and the Ensilage System, &c. By T. CHRISTY, F.L.S. With coloured illustrations. Price 1s.

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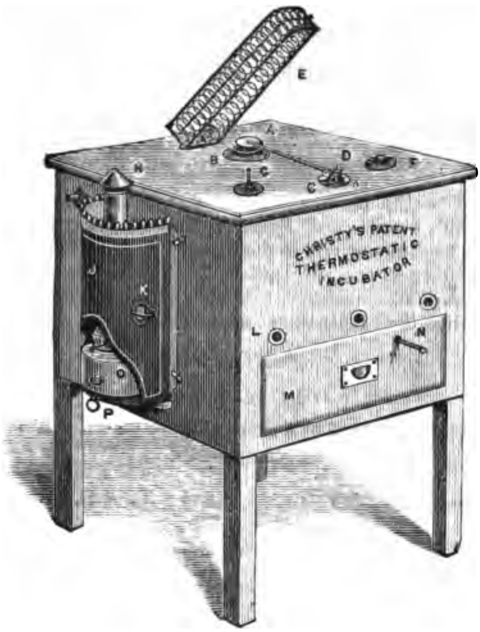

A, Valve acting upon B, the mouth of air shaft; C, rod connecting valve with the thermostatic band in the egg-drawer; D, the set screw for regulating the temperature; E, the screen protecting the valve A and the lever; F is the filling pipe; G is the pipe down which the thermometer to test the water is kept; H, the top of the chimney, in the centre of which is the boiler; I, lamp screen and stand; K, the egg tester; L are the air holes; M, the front of the drawer; N, the thermometer; O, the lamp; P, the wood slide to push lamp close up into the chimney.

An improved and patented Incubator, heated by a small Oil Lamp always kept burning, ventilated and regulated by a Thermostatic Band of metal, automatic in its action, and not liable to breakage or to get out of working order.

Rules for Working.

Fill the tank with hot water. Light the small lamp and set the regulating valve at the heat desired. After the eggs are placed in the drawer, if the lamp is trimmed morning and night, and the eggs turned once a day, no further attention is required.

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Strongly hinged stout boxes, made in 3 sizes, viz.:—

8 divisions,	10 ins. long by	4 ins. broad,	4/-
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WM. CHALLIS, Esq., Bournemouth, writes, Aug. 28th, 1882:—"The four grape boxes arrived safely and give every satisfaction; I consider them useful, simple, and cheap."

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Made of stout wood, planed and hinged, with fastenings and holes, through which a string can be passed and sealed on the top to prevent all tampering or pilfering. Movable wooden divisions keep each Peach, etc., in its place. Wrapped in wool or tissue paper, they fit in firmly, and never bruise. Stencilled "Fruit."

"Made in a simple but effective manner, and very cheap."—*Gardener's Magazine.*

Boxes for 6 Peaches,	10d ea.,	or 9/6 ⅌ doz	
,, 12 ,,	1/-	,, 11/6	,,
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THORLEY'S FOOD will prove of utmost service to those who adopt the "Ensilage System." Experience teaches that the substance comes out of silos very varied in condition; sometimes perfectly sweet, but not unfrequently rather rancid, with more or less mould. Only slight fermentation is requisite to make good ensilage, and the green chaff, from being too succulent when put in, often heats overmuch. No one can be certain how the ensilage will come out, and should it be only slightly sour, cattle and other stock would be unlikely to take to the food readily. But a complete remedy is found close at hand by mixing up a small quantity of THORLEY'S FOOD with the ensilage, or merely sprinkling the substance with this Aromatic Condiment ere offered to stock, when it would be devoured with the same zest farm animals have frequently been known to feed on the chaff of mouldy hay after being similarly treated. Agriculturists may adopt the "Silo System" with perfect confidence, having this resource, as the worst ensilage would be devoured with avidity after being flavoured by THORLEY'S FOOD.

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